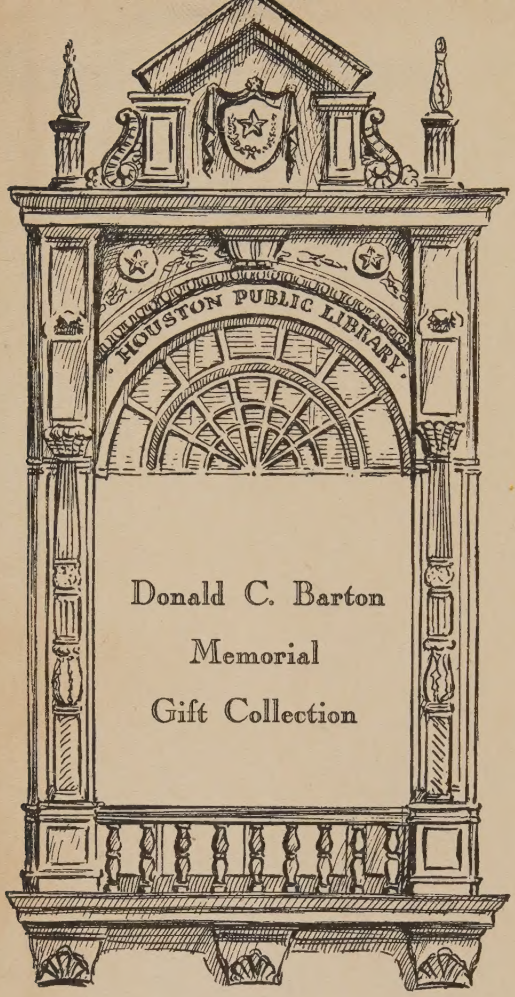

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PETROLEUM FACTS AND FIGURES

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FOREWORD

"Petroleum Facts and Figures," third edition, brings to date statistical material contained in the first edition published in 1928 and the second edition published in 1929.

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Director, Public Relations Department,
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August 1930.

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PETROLEUM
FACTS AND FIGURES

WORLD PRODUCTION AND CONSUMPTION OF PETROLEUM

PETROLEUM—WHAT IS IT?

Petroleum, one of the first natural products used by man, is a mineral hydrocarbon. Its two chief elements, hydrogen and carbon, by uniting in varying proportions with each other and with other elements, form a multitude of compounds—solid, liquid, and gaseous—each having distinct properties. In petroleum itself is found a host of hydrocarbon compounds; and, consequently, petroleums obtained from different locations, and sometimes from the same locality, differ widely in composition and properties.

The petroleum of commerce is known as " crude oil," the raw material from which thousands of products are made. Commonly crude oil is classified as paraffin-base or asphalt-base, from the nature of residues left on distillation. If it contains both paraffin and asphalt, it is known as mixed-base. Crude oil sometimes is thick like tar, sometimes oily and heavy like cream, and again light and volatile like the gasoline it yields. In color it ranges from black, yellow, and brown through shades of green to colorless. Ordinarily it is found with natural gas beneath the surface of the earth, usually in association with salt water. Like water and brine, it is obtained by drilling wells. From its source in subterranean rock it takes its name, a combination of the Latin words, " petro," rock, and " oleum," oil.

PETROLEUM, A COMMODITY

As petroleum pre-dates the dawn of man, it is not strange that it appears in myth and legend. There is evidence that natural gas and oil, seeping to the surface, furnished fuel for the fire primitive man worshiped as a sacred element. The Zoroastrians, or " Fire Worshipers," centered their

worship about the burning gas wells at Baku, beside the Caspian Sea. Nehemiah is reputed to have used oil for altar fires, calling it " nepthar," or " nepthai," from which comes our word naphtha.

The peoples of ancient China and Japan, of Persia and Judea, used petroleum centuries before the Christian era. Noah's little band caulked the ark with pitch, or bitumen, undoubtedly a form of petroleum gathered from the shores of the Dead Sea. Job told of a rock which " poured me out rivers of oil." The slime used as mortar for the Tower of Babel and other ancient structures evidently was an asphaltic petroleum. Crude oil mixed with ashes served the Syrians as fuel. In many countries, it has been for centuries the basis of medicines used to heal the wounds and cure the minor ills of man and beast. In fact, when Europeans first came to America they found the Indians using crude oil as a cure for various ailments; and the early settlers of New York, Pennsylvania, Ohio, and other states long regarded " rock oil," or " Seneca oil," as a potent family medicine.

The passing years developed many new uses for petroleum, and it is probable that today no other raw material enters so many fields of utilization. Heat, light, power, and lubrication are its major uses; but to these must be added the multitude of ways that derivatives of petroleum, either alone or compounded with other materials, enter the daily life of virtually every person in every civilized country in the world. Together they serve to make petroleum the most essential product of the present age.

PETROLEUM AROUND THE WORLD

It has been said that petroleum is one of the oldest natural products used by man, but it was only after American enterprise had inaugurated development of the industry on an extensive scale that it assumed international importance as an essential commodity. Petroleum had been obtained in small quantities in many countries for centuries.

Production had reached something like a commercial status in Galicia and Roumania, where it was obtained by the age-old method of digging open pits and lifting it to the surface in leather buckets. The idea of using derrick and drill, borrowed from brine well operators in the United States in 1859 by Drake, now has spread around the world. A forest of derricks today proclaims the oil field virtually wherever seen.

Petroleum is produced on a commercial scale in some 26 countries, with the United States by far the most important. Since recording of production was begun in 1857, the world has yielded more than 18,638,505,000 barrels, of which 12,249,149,000 barrels have come from the United States. More than 1,500,000,000 barrels now are produced annually, and in 1929 the United States supplied the billion.

Of the countries producing petroleum on a commercial scale, eight contribute 96 per cent. These are the United States, Venezuela, Russia (including Sakhalin), Mexico, Persia, Netherlands East Indies, Roumania, and Colombia.

Actual oil production is quite inequitably distributed among the continents, but the petroleum resources of some continents are still largely undeveloped. Geologists consider North America by far the richest in oil. Central America, the West Indies, and most of Mexico consist of mountain ranges too highly disturbed to be highly prolific, although the Gulf Coastal Plain of Mexico has been astonishingly productive. The British colony of Trinidad has some oil and large natural asphalt deposits. Canada and Alaska have oil possibilities not yet fully developed.

Great possibilities for oil are believed to exist in the little explored and undeveloped South American continent, since Venezuela, Colombia, Peru, and Ecuador already have yielded a rich production.

The rocks of central and western Europe, geologists say, are too broken and disturbed to permit accumulation of oil in large quantities, but many small fields have been, and probably will be developed, particularly in Roumania, Galicia, Alsace, Languedoc, Hanover, and northern Italy. In

eastern Europe, however, beneath the great plains of Russia and the Baltic countries, are broadly folded geologic beds not unlike those of the great Mid Continent oil fields of the United States. Russia particularly is believed to possess a wealth of undeveloped oil territory. Formations on the flanks of the Caucasus already have yielded quantities of oil, with most of the production taken from the Baku region. Northern Europe shows little indication of commercial accumulations. A sizable oil shale industry has been developed in Scotland, but attempts to find oil in commercial quantities generally throughout the British Isles have met with little success.

The drill, final authority for the presence of oil, has established production possibilities of Asia, especially in Iraq (Mesopotamia), southwestern Persia, the Punjab, Burma, Szechwan and Shensi provinces of China, in Siberia and in the Netherlands East Indies. Some possibilities are seen in the southwestern plateaus of Arabia, Syria, and Palestine. Production is under way in Borneo, Java, Sumatra, and Sarawak. Production only on a small scale has been developed in Africa, and that chiefly in Egypt. Australia, New Zealand, and other island countries of the Pacific Ocean show little, if any, promise.

WORLD OIL PRODUCTION

In comparing the oil production of 1929 with 1928, it is noted that, with the exception of Mexico, the major producing countries of the world showed appreciable increases. The United States, with a total of 1,006,000,000 barrels (preliminary figure), produced more oil than during any previous year, despite the fact that production in certain areas was held in check because of prevailing conditions of oversupply.

Ranking first in oil production among the countries of the world since the Drake well was drilled near Titusville, Pa., in 1859 (except for a few years when Russia led), the United States contributed 67.5 per cent of the world total in 1929.

A significant increase was recorded by Venezuela, whose production of 137,000,000 barrels in 1929 kept it in second

WORLD'S PRODUCTION OF PETROLEUM IN 1929, BY COUNTRIES, COMPARED WITH 1928

	1929		1928	
	Barrels of 42 U. S. gallons	Percentage of total by volume	Barrels of 42 U. S. gallons	Percentage of total by volume
United States	1,006,000,000	67.6	901,474,000	67.9
Venezuela	137,000,000	9.2	105,749,000	8.0
Russia	103,000,000	6.9	87,800,000	6.6
Persia	45,250,000	3.0	43,461,000	3.3
Mexico	44,689,000	3.0	50,151,000	3.8
Netherlands East Indies	37,924,000	2.6	32,118,000	2.4
Roumania	34,930,000	2.3	30,773,000	2.3
Colombia	20,385,000	1.4	19,897,000	1.5
Peru	13,404,000	0.9	12,006,000	0.9
Trinidad	8,810,000	0.6	7,684,000	0.6
Argentina	8,800,000	0.6	9,070,000	0.7
India, British	8,470,000	0.6	8,741,000	0.6
British Borneo—Sarawak	5,277,000	0.4	5,223,000	0.4
Poland	4,953,000	0.3	5,493,000	0.4
Japan and Taiwan	2,010,000	0.1	1,944,000	0.1
Egypt	1,866,000	0.1	1,842,000	0.1
Ecuador	1,351,000	0.1	1,084,000	0.1
Sakhalin, Russian	1,160,000	0.1	677,000	
Canada	1,133,000	0.1	624,000	
Iraq	798,000		713,000	
Germany	711,000		630,000	0.3
France	516,000	0.1	512,000	
Czechoslovakia	93,000		94,000	
Italy	44,000		46,000	
Other countries	30,000		24,000	
	1,488,604,000	100.0	1,327,830,000	100.0

NOTE.—This table shows the output of the various oil producing countries as reported officially to the U. S. Bureau of Mines for 1928 and the estimated production of these countries during 1929. These estimates are based upon information obtained from consular officers located in various foreign countries, information received from producing companies, and such official figures as are available.

place; Russia, with 103,000,000 barrels, also showed a gain. Persia, with 45,250,000 barrels, went ahead of Mexico which, with 44,689,000 barrels, dropped to fifth place.

World's Production of Crude Petroleum,

[Thousands of Barrels

Year	Roumania	United States	Italy	Canada	Russia[1]	Poland (Galicia)	Japan and Taiwan	Germany	India	Netherlands East Indies	Peru	Mexico	Argentina
1857-60	19	502	(3)	...	.....	....	....	....	....	....	....	....	....
1861...	17	2,114	(3)	...	.....	....	....	....	....	....	....	....	....
1862...	23	3,057	(3)	12	.....	....	....	....	....	....	....	....	....
1863...	28	2,611	(3)	83	41	....	....	....	....	....	....	....	....
1864...	33	2,116	(3)	90	65	....	....	....	....	....	....	....	....
1865...	39	2,498	2	110	67	....	....	....	....	....	....	....	....
1866...	42	3,598	1	175	83	....	....	....	....	....	....	....	....
1867...	51	3,347	1	190	120	....	....	....	....	....	....	....	....
1868...	56	3,646	(5)	200	88	....	....	....	....	....	....	....	....
1869...	59	4,215	(3)	220	202	....	....	....	....	....	....	....	....
1870...	84	5,261	(3)	250	204	....	....	....	....	....	....	....	....
1871...	90	5,205	(3)	270	165	....	....	....	....	....	....	....	....
1872...	91	6,293	(3)	308	185	....	....	....	....	....	....	....	....
1873...	104	9,894	(3)	365	475	....	....	....	....	....	....	....	....
1874...	103	10,927	1	169	585	150	....	....	....	....	....	....	....
1875...	108	8,788	1	220	697	158	5	....	....	....	....	....	....
1876...	111	9,133	3	312	1,321	164	7	....	....	....	....	....	....
1877...	108	13,350	3	312	1,801	170	10	....	....	....	....	....	....
1878...	109	15,397	4	312	2,401	176	18	....	....	....	....	....	....
1879...	110	19,914	3	575	2,761	215	23	....	....	....	....	....	....
1880...	115	26,286	2	350	3,001	229	26	9	....	....	....	....	....
1881...	122	27,661	1	275	3,601	287	17	29	....	....	....	....	....
1882...	136	30,350	2	275	4,538	330	15	58	....	....	....	....	....
1883...	139	23,450	2	250	6,002	365	20	27	....	....	....	....	....
1884...	211	24,218	3	250	10,805	408	28	46	....	....	....	....	....
1885...	193	21,859	2	250	13,925	465	30	41	....	....	....	....	....
1886...	168	28,065	2	584	18,006	306	38	74	....	....	....	....	....
1887...	182	28,283	1	526	18,368	344	29	74	....	....	....	....	....
1888...	219	27,612	1	695	23,049	467	37	85	....	....	....	....	....
1889...	298	35,164	1	705	24,609	515	53	68	94	....	....	....	....
1890...	383	45,824	3	795	28,691	659	52	108	118	....	....	....	....
1891...	488	54,293	8	755	34,573	631	53	109	190	....	....	....	....
1892...	593	50,515	18	780	35,775	646	69	101	242	....	....	....	....
1893...	535	48,431	19	798	40,457	693	106	100	299	600	....	....	....
1894...	508	49,344	21	829	36,375	949	173	123	327	688	....	....	....
1895...	576	52,892	26	726	46,140	1,453	170	121	372	1,216	....	....	....
1896...	543	60,960	18	727	47,221	2,444	237	145	430	1,427	47	....	....
1897...	571	60,476	14	710	54,399	2,226	262	166	546	2,552	71	....	....
1898...	776	55,364	15	758	61,610	2,376	319	184	542	2,964	71	....	....
1899...	1,426	57,071	16	808	65,955	2,314	539	192	941	1,796	89	....	....
1900...	1,629	63,621	12	913	75,780	2,347	871	358	1,079	2,253	274	....	....
1901...	1,678	69,389	16	757	85,168	3,251	1,117	314	1,431	4,014	275	10	....
1902...	2,060	88,767	19	531	80,540	4,142	996	354	1,617	2,430	287	40	....
1903...	2,763	100,461	18	487	75,591	5,235	1,209	446	2,510	5,770	278	75	....
1904...	3,599	117,081	26	553	78,537	5,947	1,219	637	3,385	6,508	290	126	....
1905...	4,421	134,717	44	634	54,960	5,766	1,347	561	4,137	7,850	373	251	....
1906...	6,378	126,494	54	569	58,897	5,468	1,564	579	4,016	8,181	531	502	....
1907...	8,118	166,095	60	789	61,851	8,456	1,718	757	4,344	9,983	751	1,005	(3)
1908...	8,252	178,527	51	528	62,187	12,612	1,871	1,009	5,047	10,283	945	3,933	12
1909...	9,327	183,171	42	421	65,970	14,933	1,887	1,019	6,677	11,042	1,411	2,714	18
1910...	9,724	209,557	51	316	70,337	12,673	1,829	1,032	6.138	11,031	1,258	3,634	20
1911...	11,108	220,449	75	291	66,184	10,519	1,737	1,017	6,451	12,173	1,465	12,553	13
1912...	12,976	222,935	54	243	68,019	8,535	1,659	1,031	7,117	10,846	1,752	16,558	47
1913...	13,555	248,446	47	228	62,834	7,818	1,940	857	7,930	11,172	2,071	25,696	131
1914...	12,827	265,763	40	215	67,020	6,436	2,636	781	7,410	11,422	1,837	26,235	276
1915...	12,030	281,104	44	215	68,548	5,352	2,928	703	8,202	11,920	2,579	32,911	513
1916...	8,945	300,767	51	198	65,817	6,587	2,963	656	8,491	12,547	2,593	40,546	867
1917...	3,721	335,316	41	214	63,072	6,228	2,861	642	8,079	13,180	2,577	55,293	1,218
1918...	8,730	355,928	35	305	27,168	6,032	2,441	270	8,188	12,778	2,527	63,828	1,353
1919...	6,618	378,367	35	241	31,752	6,096	2,238	265	8,736	15,508	2,628	87,073	1,331
1920...	7,435	442,929	35	196	25,430	5,607	2,221	246	8,375	17,529	2,817	157,069	1,651
1921...	8,368	472,183	32	188	28,968	5,167	2,233	274	8,734	16,958	3,699	193,398	2,036
1922...	9,843	557,531	31	179	35,692	5,227	2,055	319	8,529	17,066	5,314	182,278	2,866
1923...	10,867	732,407	34	170	39,147	5,402	1,804	346	8,406	19,870	5,699	149,585	3,400
1924...	13,369	713,940	45	161	45,355	5,657	1,814	406	8,416	20,473	8,379	139,678	4,639
1925...	16,650	763,743	70	332	52,448	5,960	1,915	541	8,274	21,422	9,252	115,515	6,336
1926...	23,314	770,874	48	364	64,311	5,844	1,900	653	8,728	21,242	10,762	90,421	7,952
1927...	26,368	901,129	44	477	77,018	5,342	1,700	663	7,878	25,967	10,135	64,121	8,630
1928...	30,773	901,474	46	624	87,800	5,493	1,944	630	8,741	32,118	12,006	50,151	9,070
1929...	34,930	1,006,000	44	1,133	103,000	4,953	2,010	711	8,470	37,924	13,404	44,689	8,800
Total...	339,943	12,249,149	1,438	28,491	2,437,760	218,225	58,963	19,937	199,637	432,703	108,447	1,559,888	61,179

[1] Exclusive of Sakhalin, which is shown separately. [2] Estimated. [3] Less than one thousand. [4] Production in previous years credited to Germany. [5] Included in others.

Authority: U. S. Bureau of Mines.

1857–1929, BY YEARS AND COUNTRIES
of 42 U. S. Gallons]

Trinidad	Egypt	Persia	Sarawak	Algeria	Ecuador	Venezuela	France	England	Czechoslovakia	Sakhalin (Russian)	Colombia	Iraq	Other countries[2]	Total	Percentage produced by United States
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	521	96
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	2,131	99
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	3,092	99
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	2,763	94
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	2,304	92
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	2,716	92
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	3,899	92
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	3,709	90
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	3,990	91
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	4,696	90
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	5,799	91
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	5,730	91
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	6,877	92
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	10,838	91
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	11,933	92
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	9,977	88
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	11,051	83
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	15,754	85
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	18,417	84
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	23,601	84
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	30,018	88
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	31,993	86
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	35,704	85
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	30,255	78
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	35,969	67
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	36,765	59
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	47,243	59
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	47,807	59
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	52,165	53
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	61,507	57
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	76,633	60
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	91,100	60
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	88,739	57
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	92,038	53
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	89,337	55
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	103,692	51
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	114,199	53
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	121,993	50
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	124,979	44
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	131,147	44
....	....	.....	...	...	...	...	...	..	..	..	...	..	..	149,137	43
....	....	.....	...	...	...	...	...	..	..	..	...	..	20	167,440	41
....	....	.....	...	...	...	...	...	..	..	..	...	..	26	181,809	49
....	....	.....	...	...	...	...	...	..	..	..	...	..	36	194,879	52
....	....	.....	...	...	...	...	...	..	..	..	...	..	40	217,948	54
....	....	.....	...	...	...	...	...	..	..	..	...	..	30	215,091	63
....	....	.....	...	...	...	...	...	..	..	..	...	..	30	213,263	59
....	....	.....	...	...	...	...	...	..	..	..	...	..	30	263,957	63
[3]	....	.....	...	...	...	...	...	..	..	..	...	..	30	285,287	63
57	....	.....	...	...	...	...	...	..	..	..	...	..	20	298,709	61
143	....	.....	...	...	...	...	...	..	..	..	...	..	20	327,763	64
285	21	.....	...	...	...	...	...	..	..	..	...	..	20	344,361	64
437	214	.....	...	...	...	...	...	..	..	..	...	..	20	352,443	63
504	98	1,857	141	...	...	...	...	..	..	..	...	..	20	385,345	64
644	753	2,910	318	1	...	...	...	..	..	..	...	..	20	407,544	65
750	212	3,616	392	4	...	...	...	..	..	..	...	..	10	432,033	65
929	404	4,477	629	8	...	...	...	..	..	..	...	..	25	457,500	66
1,602	943	7,147	542	9	57	120	....	..	..	..	...	..	29	502,891	67
2,082	1,935	8,623	504	7	[2] 60	333	[4] 363	..	..	..	...	..	25	503,515	71
1,841	1,517	10,139	596	5	[2] 60	425	334	2	48	..	...	..	20	555,875	68
2,083	1,042	12,230	1,020	4	[2] 60	457	356	3	69	..	...	..	20	688,884	64
2,354	1,255	16,673	1,411	3	[2] 60	1,433	389	3	94	2	...	..	20	765,935	62
2,445	1,188	22,247	2,849	9	[2] 60	2,201	496	1	120	7	323	..	22	858,898	65
3,051	1,054	25,230	3,940	9	87	4,201	494	1	74	9	424	..	24	1,015,735	72
4,057	1,122	32,373	4,163	11	[2] 100	9,042	497	2	76	80	445	..	24	1,014,324	70
4,387	1,226	35,038	4,257	12	160	19,687	59	3	158	87	1,007	..	23	1,068,962	71
5,278	1,188	35,842	4,942	9	214	37,226	478	3	150	181	6,444	..	21	1,098,389	70
5,712	1,267	39,688	4,943	[5]	537	63,134	504	[5]	149	440	15,002	200	25	1,261,473	72
7,684	1,842	43,461	5,223	[5]	1,084	105,749	512	[5]	94	677	19,897	713	24	1,327,830	68
8,810	1,866	45,250	5,277	[5]	1,351	137,000	516	[5]	93	1,160	20,385	798	30	1,488,604	68
55,135	19,147	346,801	41,147	91	3,890	381,008	5,398	18	1,125	2,643	63,927	1711	704	18,638,505	66

[1] Exclusive of Sakhalin, which is shown separately. [2] Estimated. [3] Less than one thousand. [4] Production in previous years credited to Germany. [5] Included in others.

Authority: U. S. Bureau of Mines

WORLD'S TOTAL CRUDE OIL PRODUCTION FROM 1857

(Thousands of Barrels of 42 U. S. Gallons)

Country	Date of first recorded production	Total production through 1929	Per cent of total
Roumania	1857	339,943	1.82
United States	1859	12,249,149	65.72
Italy	1860	1,438	0.01
Canada	1862	28,491	0.15
Russia	1863	2,437,760	13.08
Poland	1874	218,225	1.17
Japan and Taiwan	1875	58,963	0.32
Germany	1880	19,937	0.11
India, British	1889	199,637	1.07
Netherlands East Indies	1893	432,703	2.32
Peru	1896	108,447	0.58
Mexico	1901	1,559,888	8.37
Argentina	1907	61,179	0.33
Trinidad	1908	55,135	0.30
Egypt	1911	19,147	0.10
Persia	1913	346,801	1.86
Sarawak	1913	41,147	0.22
Algeria	1914	91	....
Ecuador	1917	3,890	0.02
Venezuela	1917	381,008	2.05
France	1918	5,398	0.03
England	1919	18	....
Czechoslovakia	1919	1,125	0.01
Sakhalin, Russian	1921	2,643	0.01
Colombia	1922	63,927	0.34
Iraq	1927	1,711	0.01
Others		704	....
Total		18,638,505	100.00

Authority: U. S. Bureau of Mines.

WORLD TRANSPORTATION OF PETROLEUM

The oil producing fields of the world are connected by railroads or pipe lines, either with seacoast terminals or with refineries. Thence crude oils, or refined products, are transported by tank steamer, tank car, and tank trucks to the markets. Tanker fleets, almost entirely owned by oil companies, comprise a substantial percentage of the world's merchant tonnage.

Of the total merchant tonnage (steam and motor vessels) registered under the American flag, about 17 per cent is

World Tankers[1]
(500 Gross Tons and Over)

Flag	June 30, 1914						June 30, 1928						June 30, 1929					
	Steam and gas		Sail and barge		Total		Steam and gas		Sail and barge		Total		Steam and motor		Sail and barge		Total	
	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross
American[2]	26	94,466	28	56,219	54	150,685	385	2,315,889	99	122,714	484	2,438,603	396	2,320,592	107	124,525	503	2,445,117
Argentine	..	.....	..	.....	..	.....	14	76,870	3	4,760	17	81,630	16	75.485	3	4,760	19	80,245
Belgian	8	25,811	..	.....	8	25,811	9	53,313	..	.....	9	53,313	5	25,842	..	.....	5	25,842
British	181	815,849	7	21,561	188	837,410	414	2,492,301	6	17,207	420	2,509,508	492	2,563,840	5	16,330	497	2,580,170
Chinese	..	.....	..	.....	..	.....	1	570	..	.....	1	570	1	510	..	.....	1	510
Cuban	..	.....	..	.....	..	.....	4	10,176	4	4,125	8	14,301	3	4,690	4	4,125	7	8,815
Danish	..	.....	1	735	1	735	5	35,506	..	.....	5	35,506	9	59,475	..	.....	9	59,475
Danzig	..	.....	..	.....	..	.....	13	113,003	..	.....	13	113,003	14	115,203	..	.....	14	115,203
Dominican	..	.....	..	.....	..	.....	1	1,970	..	.....	1	1,970	1	1,970	..	.....	1	1,970
Dutch	27	72,766	8	8,642	35	81,408	64	210,913	3	2,207	67	213,120	78	284,035	2	1,580	80	285,615
Finnish	..	.....	..	.....	..	.....	1	691	..	.....	1	691	2	1,907	..	.....	2	1,907
French	3	11,232	..	.....	3	11,232	27	149,999	..	.....	27	149,999	27	152,976	..	.....	27	152,976
German	46	215,844	1	728	47	216,572	29	118,776	..	.....	29	118,776	29	122,215	..	.....	29	122,215
Greek	1	1,633	..	.....	1	1,633	1	2,296	1	2,296	2	4,592	2	3,208	1	2,296	3	5,504
Italian	3	16,007	..	.....	3	16,007	61	216,316	..	.....	61	216,316	54	232,492	..	.....	54	232,492
Japanese	4	19,808	..	.....	4	19,808	16	74,510	..	.....	16	74,510	18	86,575	..	.....	18	86,575
Mexican	4	13,464	..	.....	4	13,464	3	12,202	5	3,770	8	15,972	2	7,737	5	3,770	7	11,507
Moroccan	..	.....	..	.....	..	.....	1	552	..	.....	1	552	1	522	..	.....	1	522
Norwegian	9	48,042	1	1,254	10	49,296	87	534,857	..	.....	87	534,857	109	703,893	..	.....	109	703,893
Panaman	..	.....	..	.....	..	.....	1	9,000	..	.....	1	9,000	1	8,947	..	.....	1	8,947
Peruvian	..	.....	..	.....	..	.....	2	8,629	..	.....	2	8,629	2	9,015	..	.....	2	9,015
Portuguese	..	.....	..	.....	..	.....	1	1,739	..	.....	1	1,739	1	1,083	..	.....	1	1,083
Roumanian	..	.....	..	.....	..	.....	3	14,893	..	.....	3	14,893	3	14,737	..	.....	3	14,737
Russian	6	14,371	..	.....	6	14,371	6	22,661	..	.....	6	22,661	9	33,937	..	.....	9	33,937
Spanish	1	672	..	.....	1	672	12	35,662	..	.....	12	35,662	9	28,868	..	.....	9	28,868
Swedish	1	2,092	..	.....	1	2,092	5	28,642	..	.....	5	28,642	10	66,531	..	.....	10	66,531
Uruguayan	..	.....	..	.....	..	.....	2	2,840	..	.....	2	2.840	2	2,840	..	.....	2	2,840
Venezuelan	..	.....	..	.....	..	.....	14	33,605	3	4,706	17	38,311	19	49,332	2	3,325	21	52,657
Total	320	1,352,057	46	89,139	366	1,441,196	1,182	6,578,351	124	161,785	1,306	6,740,136	1,315	6,978,457	129	160,711	1,444	7,139,168

[1] Exclusive of Navy, Admiralty, and other government tankers. [2] Including tankers on Great Lakes.

Authority: All figures, except for American tankers, are prepared from Lloyd's Register.

composed of tank steamers. Tankers comprise over 10 per cent of all world tonnage. The tonnage of world tankers in 1914 amounted to 1,441,000 gross tons. By the end of the war (1919) the tonnage had increased to 2,773,000 gross

WORLD TANKERS *
(500 Gross Tons and Over)

Year	Steam and motor		Sail and barge		Total	
	Number	Gross	Number	Gross	Number	Gross
1929	1,315	6,978,457	129	160,711	1,444	7,139,168
1928	1,182	6,578,351	124	161,785	1,306	6,740,136
1927	1,050	5,640,321	116	149,913	1,166	5,790,234
1926	1,001	5,375,854	106	143,620	1,107	5,519,474
1925	961	5,156,766	111	153,767	1,072	5,310,533
1924	952	5,103,909	89	137,874	1,041	5,241,783
1923	938	5,013,484	98	147,050	1,036	5,160,534
1922	852	4,662,618	98	143,786	950	4,806,404
1921	745	3,790,166	95	144,661	840	4,114,827
1920	582	2,929,521	91	138,609	673	3,068,130
1919	536	2,644,226	89	129,041	625	2,773,267
1914	320	1,352,057	46	89,139	366	1,441,196

* Exclusive of Navy, Admiralty, and other government tankers.

tons; by 1927, to 5,790,000 gross tons; and by 1929, to 7,139,000 gross tons.

American tankers represented a tonnage of 151,000 gross tons in 1914; in 1927, 2,423,000 gross tons; and in 1929, 2,445,000 gross tons. British tanker tonnage in 1928 took the leading position (which it had yielded for several years) from American tonnage, with a total 2,510,000 gross tons. In 1914 Great Britain was far in the lead, with 837,000 gross tons. In 1929 it had a tanker tonnage of 2,580,000 gross tons.

WORLD CONSUMPTION OF OIL

The United States, with the largest production and the greatest refinery capacity, consumes more oil than any country in the world. In no small part the relatively high consumption in this country has been due to the necessity of meeting the demand for gasoline for the motor car.

Production of petroleum in America dates back to 1859, and from the earliest days the United States has supplied the bulk of the world's oil.

The first important use to be discovered for petroleum was as a burning oil in lamps. Before the general introduction of electricity, kerosene or its predecessor, "coal oil," gave the world light; and the world had to come to the United States for a large part of its supply.

The industrialization and mechanization of Europe created a vast market for lubricants.

In the early days of the twentieth century, automotive development in the United States began to make great forward strides; and by 1910 the automobile was creating a new demand for gasoline—a petroleum product. The obvious success of the petroleum industry's efforts to supply this hitherto unprecedented demand for gasoline, created by the phenomenal growth of the automobile, has resulted in the parallel growth of these two giant industries, whose prosperity is so vital to the economic welfare of the United States.

The world was brought to a full realization of the essential importance of petroleum in every-day life, in industry, and in safeguarding national security, by the World War. The great development in the use of fuel oil in factories and in ships, the remarkable strides of aviation—with its attendant demand for specialized fuels and lubricants—also had their inception during the war.

As of December 31, 1929, a world census accounted for 34,877,000 motor vehicles, of which 26,501,000, or about 76 per cent, were in use in the United States.

World Motor Vehicle Registrations by Years

December 31	United States	Outside United States	Total World
1916	3,512,996	719,246	4,232,242
1919	7,565,446	1,286,948	8,852,394
1920	9,231,941	1,710,983	10,942,924
1921	10,464,715	2,254,785	12,719,500
1922	12,239,853	2,379,091	14,618,944
1923	15,092,177	3,120,525	18,212,702
1924	17,595,373	3,862,294	21,455,971
1925	19,954,347	4,519,282	24,473,629
1926	22,001,393	5,648,874	27,650,267
1927	23,133,243	6,554,256	29,687,499
1928	24,493,124	7,285,079	31,778,203
1929	26,501,443	8,375,394	34,876,837

WORLD REGISTRATIONS OF MOTOR VEHICLES, DECEMBER 31, 1929

Country	Passenger cars	Buses	Trucks	Total motor vehicles	Population per motor vehicle
Aden	542	78	46	666	101
Afghanistan	338	....	112	450	17,778
*Alaska	1,731	....	769	2,500	26
Albania	700	4	500	1,204	692
*Algeria	37,500	1,110	6,300	44,910	133
*Angola	950	....	1,050	2,000	1,243
Antigua	188	3	22	213	141
*Arabia, exc. Aden	504	....	238	742	9,450
Argentina	296,224	2,600	65,913	364,737	30
Australia	461,291	2,238	117,781	581,310	10
Austria	19,950	2,500	15,100	37,550	178
Azores	469	35	30	534	434
*Bahamas	900	....	350	1,250	44
Barbados	1,300	135	180	1,615	104
*Belgian Congo	2,400	....	2,450	4,850	1,755
Belgium	90,000	1,000	46,500	137,500	58
Bermuda	....	....	10	10	3,200
*Bolivia	1,700	95	910	2,705	1,092
*Borneo, British	60	....	20	80	3,220
*Brazil	124,424	....	63,925	188,349	208
*British East Africa	9,100	....	5,600	14,700	660
British Honduras	165	....	42	207	237
British South Africa:					
Nyassaland	670	25	480	1,175	1,112
Rhodesia, North	700	15	300	1,015	998
Rhodesia, South	8,600	150	1,370	10,120	125
British South West Africa.	2,770	10	840	3,620	73
British West Africa:					
*Gamba	220	....	81	301	700
Gold Coast	1,943	9	4,833	6,875	309
*Nigeria	2,450	....	3,550	6,000	3,100
*Sierra Leone	783	....	314	1,097	1,401
*Bulgaria	2,619	....	1,082	3,701	1,482
Canada	1,018,967	1,768	147,453	1,168,188	8
Ceylon	14,476	2,694	2,818	19,982	271
Chile	22,649	1,674	8,673	32,996	132
China (exc. Hong Kong)	22,912	6,410	6,167	35,489	12,258
Chosen (Korea)	992	1,729	780	3,501	5,576
*Colombia	10,000	....	6,000	16,000	500
Cook Islands	58	....	48	106	131
Costa Rica	1,651	150	480	2,281	207
Cuba	33,577	1,826	14,703	50,106	72
*Cyprus	843	....	461	1,304	242
Czechoslovakia	42,690	1,530	14,180	58,400	247
Danzig	1,369	48	730	2,147	182
Denmark	70,500	1,125	29,000	100,625	35
Dominica	36	3	6	45	912
*Dominican Republic	3,165	64	1,032	4,261	212
Ecuador	1,626	109	789	2,524	792
*Egypt	22,013	....	4,372	26,385	536
*Eritrea	250	....	150	400	1,016
Estonia	1,755	170	870	2,795	399
Ethiopia	502	....	66	568	17,781
*Faroe Islands	15	12	25	52	410
Fiji Islands	876	78	134	1,088	160
Finland	22,462	1,233	9,445	33,140	108
France	885,000	15,000	340,000	1,240,000	33
French Equa. Africa	344	....	566	910	3,436
*French Indo China	15,000	1,981	3,776	20,757	956
French West Africa	2,897	2	4,139	7,038	1,924

* Figures from the *American Automobile's* "1930 World Census."
Authorities: Automotive Division, Department of Commerce, and *The American Automobile.*

WORLD REGISTRATIONS OF MOTOR VEHICLES, DECEMBER 31, 1929 (*Continued*)

Country	Passenger cars	Buses	Trucks	Total motor vehicles	Population per motor vehicle
*Germany	458,060	....	150,970	609,030	102
Gibraltar	481	44	88	613	26
Greece	12,500	1,100	4,250	17,850	348
*Grenada	308	49	40	397	170
Guadeloupe	1,189	132	120	1,441	169
*Guam	178	4	109	291	58
Guatemala	2,263	141	693	3,097	758
Guiana, British	1,188	90	132	1,410	218
*Guiana, Surinam	170	....	25	195	730
*Guiana, French	65	....	35	100	442
Haiti	2,245	252	499	2,996	851
Hawaii	35,254	224	9,566	45,044	7
*Honduras	675	....	375	1,050	735
Hong Kong	1,696	162	498	2,356	415
Hungary	13,293	690	5,069	19,052	451
Iceland	550	40	650	1,240	82
*India	125,922	....	38,353	164,275	1,942
*Iraq	2,298	....	613	2,911	1,003
*Irish Free State	29,435	705	7,264	37,404	79
*Italy	173,242	7,928	49,339	230,509	177
Jamaica	6,271	115	2,186	8,572	111
*Japan (proper)	52,769	....	31,711	84,480	702
Latvia	1,674	274	1,021	2,969	639
*Liberia	†300	....	....	300	500
*Libya	†732	....	....	732	780
Lithuania	1,254	270	405	1,929	1,201
Luxemburg	6,021	167	2,419	8,607	33
Madagascar	2,009	....	714	2,723	1,359
Madeira Island	650	110	70	830	215
Malaya, British	29,900	2,000	5,600	37,500	103
Maltese Island	1,364	385	230	1,979	115
Martinique	1,530	18	461	2,009	122
Mauritius	1,975	120	298	2,393	168
Mexico	55,000	4,500	14,800	74,300	202
Monaco	1,449	60	91	1,600	16
Montserrat	38	4	6	48	248
Morocco, French	16,995	....	6,820	23,815	177
Morocco, Int. Zone	751	48	392	1,191	67
Morocco, Spanish	872	....	669	1,541	649
*Netherlands	61,928	....	36,500	98,428	76
Netherlands East Indies	62,846	7,257	11,425	81,528	642
*Netherlands West Indies	†2,000	....	....	2,000	30
Newfoundland	2,141	9	360	2,510	107
New Caledonia	800	10	50	860	67
New Hebrides	12	....	50	62	766
New Zealand	143,841	1,238	28,733	173,812	8
Nicaragua	850	4	150	1,004	647
Norway	26,000	1,650	13,000	40,650	69
Palestine	1,971	468	564	3,003	295
Panama and Canal Zone	5,578	459	367	6,404	78
Papua, New Guinea	69	....	101	170	1,626
*Paraguay	865	....	772	1,637	484
*Persia	4,754	....	1,974	6,728	1,490
Peru	8,660	505	5,450	14,615	416
Philippine Islands	23,341	2,889	8,413	34,643	344
Poland	25,279	3,441	6,086	34,806	868
Porto Rico	9,294	430	2,767	12,491	117
Portugal	23,350	1,207	4,023	28,580	205
Portuguese East Africa	900	7	500	1,407	2,643
*Reunion	875	5	150	1.030	167

* Figures from the *American Automobile's* "1930 World Census."
† All types.
Authorities: Automotive Division, Department of Commerce, and *The American Automobile.*

WORLD REGISTRATIONS OF MOTOR VEHICLES, DECEMBER 31, 1929 (*Continued*)

Country	Passenger cars	Buses	Trucks	Total motor vehicles	Population per motor vehicle
Roumania	26,500	4,982	4,500	35,982	497
*Russia	10,000	2,500	11,500	24,000	6,130
St. Christopher-Nevis	171	9	21	201	178
St. Lucia	109	3	34	146	384
*St. Pierre and Miguelon	44	....	30	74	60
Salvador	1,941	110	279	2,330	725
Samoa, American	21	7	24	52	169
*Samoa, Western	179	....	109	288	140
*Seychelles, Island	14	....	....	14	....
*Siam	4,300	....	3,250	7,550	1,300
Society Islands	335	10	75	420	85
Solomon Islands	....	....	14	14	10,750
Somaliland, British	22	30	....	52	6,629
Somaliland, French	124	....	28	152	564
Somaliland, Italian	102	....	326	428	2,804
*Spain, inc. Canary Islands	129,668	....	48,508	178,176	125
*Spitzbergen	....	....	1	1	1,563
*Sudan, Anglo-Egyptian	1,018	....	1,158	2,176	2,970
*Sweden	104,368	....	40,151	144,519	42
Switzerland	57,400	600	13,916	71,916	56
*Syria	7,466	....	1,582	9,048	330
*Taiwan	1,142	....	825	1,967	1,910
*Tonga (Friendly) Islands ‡	104	2	64	170	147
*Trinidad and Tobago	4,500	....	1,400	5,900	62
Tunisia	12,141	100	1,500	13,741	160
*Turkestan and Transcaucasia	68	....	6	74	....
*Turkey	6,000	....	3,000	9,000	1,515
Union of South Africa	126,000	1,200	14,500	141,700	55
United Kingdom:					
Channel Island	†5,326	....	....	5,326	17
England	904,661	41,482	296,696	1,242,839	30
Northern Ireland	17,810	756	6,098	24,664	51
Scotland	83,141	5,312	30,019	118,472	41
Wales	43,343	3,094	14,751	61,188	36
United States	23,035,750	92,500	3,373,193	26,501,443	4.6
Uruguay	36,100	875	9,000	45,975	39
Venezuela	11,350	575	5,500	17,425	174
Virgin Islands	486	5	117	608	43
*Yugoslavia	8,125	550	2,000	10,675	1,200
World total	29,355,559	241,526	5,279,752	34,876,837	54.6

* Figures from the *American Automobile's* "1930 World Census."
† All types. ‡ January 1, 1929.
Authorities: Automotive Division, Department of Commerce, and *The American Automobile.*

Five years ago it was estimated that the world ratio of people to the automobile (as of December 31, 1925) was 71 to 1; a year later the gap had narrowed to 66 to 1; by 1927 the ratio was about 60 to 1; and at the end of 1929 the ratio was 58 to 1.

WORLD AIRCRAFT DEVELOPMENT

Aircraft development in certain countries is making a new market of great potentiality for gasoline and lubricating oils. (See "Utilization of Gasoline.")

WORLD OIL-BURNING SHIPS

The growth in the use of fuel oil for industrial and marine purposes is no less sensational than the increase in the use of gasoline. A tendency on the part of the Great Powers toward conversion of battleships into oil burners was noted just preceding the World War, and became an actual development before the war was over. New vessels, as they came off the ways, became oil burners; and when the war ended, the conversion was virtually complete. All the navies of the

World Oil Burners

(500 Gross Tons and Over)

Year	Steam engine		Oil engine		Total	
	Number	Gross	Number	Gross	Number	Gross
1929.....	3,406	18,812,689	1,118	5,604,029	4,524	24,416,718
1928.....	3,558	18,741,884	1,009	4,572,171	4,567	23,314,055
1927.....	3,373	17,980,414	881	3,674,426	4,254	21,654,840
1926.....	3,311	17,791,690	757	3,035,375	4,068	20,827,065
1925.....	3,214	17,215,342	608	2,157,273	3,822	19,372,615
1924.....	3,086	16,470,202	500	1,558,722	3,586	18,028,924
1923.....	2,917	15,229,946	431	1,248,158	3,348	16,478,104
1922.....	2,694	13,838,178	416	1,166,370	3,110	15,004,548
1921.....	2,474	12,415,181	374	959,471	2,848	13,374,652
1920.....	1,731	8,345,913	290	693,334	2,021	9,039,247
1914.....	441	1,527,728	60	194,019	501	1,721,747

Great Powers are now on an oil burning basis. Of even more significance in its effect upon the petroleum and coal industries—the one favorably and the other unfavorably—was a similar conversion to an oil burning basis of the merchant shipping of the world.

Thus, before the war (1914), of the world's total gross tonnage (steam and gas) amounting to 45,404,000 tons, probably less than 4 per cent burned oil. In 1920 the world's tonnage had increased to 53,905,000 tons, of which oil burners represented about 17 per cent. In 1929 the total tonnage was 66,407,000 tons, of which 24,417,000 tons, or 36 per cent, were listed as oil burners.

The American merchant marine has an oil burning tonnage of 9,028,000 gross tons, the largest of any country. In 1914 its oil burning tonnage amounted to only 656,000

World Oil-Burning Ships[1]
(500 Gross Tons and Over)

Flag	June 30, 1914						June 30, 1928						June 30, 1929					
	Steam engine		Oil engine		Total		Steam engine		Oil engine		Total		Steam engine		Oil engine		Total	
	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross
American[2]	231	646,048	8	10,316	239	656,364	1,835	8,915,397	135	402,747	1,970	9,318,144	1,638	8,581,316	118	446,943	1,756	9,028,259
Argentine	..	.....	..	.....	..	.....	21	86,114	13	13,262	34	99,376	22	90,769	22	32,728	44	123,497
Austrian	6	25,241	..	.....	6	25,241	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....
Belgian	1	570	2	9,028	3	9,598	6	32,893	2	12,699	8	45,592	6	27,535	5	32,564	11	60,099
Brazilian	1	3,822	..	.....	1	3,822	4	20,484	16	47,947	20	68,431	5	20,281	16	47,900	21	68,181
British	111	526,585	10	30,158	121	556,743	921	5,700,740	280	1,583,854	1,201	7,284,594	929	5,811,097	330	2,067,014	1,259	7,878,111
Chilean	..	.....	..	.....	..	.....	5	18,666	1	2,044	6	20,710	4	19,575	..	.....	4	19,575
Chinese	1	2,230	1	612	2	2,842	2	4,601	1	704	3	5,305	1	2,030	1	784	2	2,814
Cuban	..	.....	..	.....	..	.....	9	17,390	..	.....	9	17,390	8	17,394	..	.....	8	17,394
Danish	..	4,199	10	49,249	11	53,448	18	67,805	51	249,183	69	316,988	15	56,739	59	287,053	74	343,792
Danzig	..	.....	..	.....	..	.....	3	25,271	6	46,352	9	71,623	3	25,271	10	87,800	13	113,071
Dutch	36	76,535	6	14,097	42	90,632	172	808,684	47	245,089	219	1,053,773	180	850,542	63	306,307	243	1,156,849
Egyptian	..	.....	..	.....	..	.....	2	2,127	..	.....	2	2,127	2	2,110	..	.....	2	2,100
Estonian	..	.....	..	.....	..	.....	..	.....	4	2,359	4	2,359	..	.....	3	1,812	3	1,812
Finnish	..	.....	..	.....	..	.....	1	2,622	4	3,641	5	6,263	1	2,622	6	5,691	7	8,313
French	..	.....	4	15,388	4	15,388	81	542,613	5	11,207	86	552,820	86	557,153	13	57,009	99	614,162
German	23	119,138	10	45,733	33	164,871	66	450,176	91	418,512	157	868,688	71	562,483	98	511,723	169	1,074,206
Greek	..	.....	..	.....	..	.....	11	48,803	2	2,840	13	51,643	13	55,758	1	2,296	14	58,054
Guatemalan	..	.....	..	.....	..	.....	..	.....	1	597	1	597	..	.....	1	597	1	597
Honduran	..	.....	..	.....	..	.....	22	59,745	1	623	23	60,368	25	70,291	..	.....	25	70,291
Italian	1	979	2	1,113	3	2,092	82	513,703	57	285,521	139	799,224	89	585,640	79	427,294	168	1,012,934
Japanese	5	46,131	..	.....	5	46,131	91	560,640	33	125,953	124	686,593	98	589,760	41	181,128	139	770,888
Latvian	..	.....	..	.....	..	.....	..	.....	1	1,527	1	1,527	..	.....	2	2,040	2	2,040
Mexican	6	17,795	..	.....	6	17,795	13	31,833	..	.....	13	31,833	14	34,319	..	.....	14	34,319
Moroccan	..	.....	..	.....	..	.....	..	.....	1	522	1	522	..	.....	1	522	1	522
Nicaraguan	..	.....	..	.....	..	.....	1	1,577	..	.....	1	1,577	2	3,138	..	.....	2	3,138
Norwegian	5	31,075	2	2,878	7	33,953	102	514,358	155	686,494	257	1,200,852	102	545,980	186	915,597	288	1,461,577
Panaman	..	.....	..	.....	..	.....	2	8,069	11	27,714	13	35,783	3	10,889	10	25,831	13	36,720
Peruvian	5	18,192	..	.....	5	18,192	8	21,136	3	4,808	11	25,944	9	28,370	2	3,120	11	31,490
Philippine	..	.....	..	.....	..	.....	4	7,987	..	.....	4	7,987	..	.....	..	.....	..	.....
Polish	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	1,293	1	1,293
Portuguese	..	.....	..	.....	..	.....	4	35,901	1	1,701	5	37,602	3	5,689	2	2,266	5	7,955
Roumanian	..	.....	..	.....	..	.....	10	26,238	..	.....	10	26,238	10	29,299	..	.....	10	29,299
Russian	3	5,979	..	.....	3	5,979	..	.....	14	49,053	14	49,053	1	2,674	27	96,135	28	98,809
Siamese	5	3,209	..	.....	5	3,209	6	4,917	2	1,964	8	6,881	6	4,837	2	1,964	8	6,801
Spanish	..	.....	..	.....	..	.....	22	85,718	12	41,336	34	127,054	22	92,250	16	55,041	38	147,291
Swedish	..	.....	4	14,895	4	14,895	18	85,148	57	299,961	75	385,109	16	67,401	..	.....	16	67,401
Uruguayan	..	.....	1	552	1	552	3	7,178	2	1,957	5	9,135	2	5,525	3	3,577	5	9,102
Venezuelan	..	.....	..	.....	..	.....	12	27,705	..	.....	12	27,705	19	48,307	..	.....	19	48,307
Yugoslavian	..	.....	..	.....	..	.....	1	5,645	..	.....	1	5,645	1	5,645	..	.....	1	5,645
Total	441	1,527,728	60	194,019	501	1,721,747	3,558	18,741,884	1,009	4,572,171	4,567	23,314,055	3,406	18,812,689	1,118	5,604,029	4,524	24,416,718

[1] Exclusive of Army, Navy, Admiralty, and other government oil burners. [2] Including oil burners on Great Lakes.

Authority: All figures, except for American vessels, are prepared from Lloyd's Register.

gross tons. Great Britain has an oil burning tonnage of 7,878,000 gross tons, and in 1914 its total was approximately 557,000 gross tons.

GROWTH OF MOTOR SHIPS

The rapid growth of the motor or oil engine ship since the World War is revealed in the preceding tables, showing a gross world tonnage in 1920 of 693,000 tons, as contrasted with the present tonnage of 5,604,000 tons. The world's mercantile marine is being rapidly "Dieselized."

About half the ships launched in the world in 1929 were automobiles of the sea; that is, their power was furnished by internal combustion engines similar in principle to the motor car engine.

World Launchings[1]

MERCHANT VESSELS OF 100 GROSS TONS AND OVER (STEEL AND WOOD) LAUNCHED DURING THE YEAR ENDED DECEMBER 31, 1929

Year	Steam		Motor		Sail and barge		Total	
	No.	Gross	No.	Gross	No.	Gross	No.	Gross
1929	634	1,504,303	347	1,269,888	31	19,019	1,012	2,793,210
1928	507	1,477,092	302	1,183,229	60	38,918	869	2,699,239
1927	480	1,375,828	254	863,694	68	46,157	802	2,285,679
1926	319	926,128	206	704,006	75	44,843	600	1,674,977
1925	544	1,298,696	198	843,629	113	51,079	855	2,193,404
1924	689	1,698,943	149	502,398	86	47,010	924	2,247,751
Country								
America:								
Atlantic and Gulf coasts	11	44,192	25	32,680	13	11,742	49	88,614
Pacific coast	3	8,088	5	2,080	2	1,850	10	12,018
Great Lakes	3	23,739	1	1,692	..	.....	4	25,431
Total	17	77,019	31	36,452	15	13,592	63	126,063
Belgium	3	8,088	1	273	..	.....	4	8,361
China	6	7,043	3	2,193	..	.....	9	9,236
Danzig	4	5,013	1	5,978	..	.....	5	10,991
Denmark	10	16,847	24	94,649	..	.....	34	111,496
France	7	16,429	6	62,928	3	2,250	16	81,607
Germany	57	155,988	28	93,089	..	.....	85	249,077
Italy	12	16,050	20	55,447	..	.....	32	71,497
Japan	10	29,784	30	134,673	..	.....	40	164,457
Netherlands	29	55,425	48	131,092	..	.....	77	186,517
Norway	43	23,626	8	15,978	..	.....	51	39,604
Russia	7	10,994	9	22,620	..	.....	16	33,614
Spain	..	.....	8	37,023	..	.....	8	37,023
Sweden	4	2,756	25	104,490	..	.....	29	107,246
Other countries	2	287	2	370	..	.....	4	657
United Kingdom	403	1,055,889	77	464,188	9	2,546	489	1,522,623
British Dominions:								
Canada—								
Coast	3	3,355	13	4,098	3	480	19	7,933
Great Lakes	3	11,814	..	.....	..	.....	3	11,814
Other	14	8,896	13	4,347	1	151	28	13,394
Total British	423	1,079,954	103	472,633	13	3,177	539	1,555,764
World total	634	1,504,303	347	1,269,888	31	19,019	1,012	2,793,210

[1] This statement embraces vessels launched during the year without regard to the date of completion. Authority: Lloyd's Register of Shipping.

AMERICAN PARTICIPATION IN WORLD MARKETS

Crude oil supplies which are developed in remote countries, to be marketable, must find their way to refineries and be converted into salable products. The United States, in the development of its own petroleum resources, has built up a great refining industry. Its facilities for manufacturing the products which are in demand have attracted, and will continue to attract, foreign raw material; and its position in supplying the world with petroleum products will remain important, until such time as foreign production and refining facilities are far more extensively developed than they are at present.

For these reasons, imports of oil into the United States do not indicate with any exactitude the barrelage extent of America's actual dependence upon foreign oil. Most of the oil imported is of heavy quality, suitable for use chiefly as fuel oil, and much of it goes into marine use. Some is "topped" or refined, however; and, with modern refining methods, an increasing gasoline recovery is being obtained.

U. S. Petroleum Production and Imports

Year	U. S. production barrels	Imports *
1918	355,928,000	38,943,000
1919	378,367,000	54,161,000
1920	442,929,000	108,794,000
1921	472,183,000	128,776,000
1922	557,531,000	135,947,000
1923	732,407,000	99,608,000
1924	713,940,000	94,534,000
1925	763,743,000	78,137,000
1926	770,874,000	81,284,000
1927	901,129,000	71,662,000
1928	901,474,000	91,167,000
1929	1,005,598,000	108,567,000

* All oil.

Authorities: U. S. Bureau of Mines and U. S. Bureau of Foreign and Domestic Commerce.

EXPORTS OF PETROLEUM

Total exports of domestic merchandise from the United States in 1929, according to the U. S. Bureau of Foreign and Domestic Commerce, were $5,157,409,000, of which crude petroleum and petroleum products contributed $531,173,000, or over 10 per cent. The value of exports of crude petroleum and petroleum products in that year is shown in the following table:

Crude oil	$37,800,000
Refined products	493,373,000
	$531,173,000

The value of the principal refined petroleum products exported in the same year is shown in the following table:

Gasoline	$266,904,000
Kerosene	83,788,000
Gas and fuel oil	37,200,000
Lubricating oil	102,899,000

Crude oil and each of its refined products are subject in export, as well as in domestic, commerce to distinctly different trade factors—the various products, although they come from a common source, being almost totally different as regards factors of supply and demand. Exports of crude oil are negligible as compared with total domestic production and imports. The bulk of the outgoing crude oil goes across the border by pipe line to supply Canadian refineries. The exportation of kerosene and lubricating oils consumes a considerable proportion of the total of both domestic production and imports. The exportation of gasoline, and of gas oil and fuel oil, is relatively small.

The relation of exports to total supply is shown in the following table:

RELATION OF PETROLEUM EXPORTED TO U. S. PRODUCTION AND IMPORTS, IN 1929

	U. S. production and imports * barrels	Exports barrels	Per cent exports
Crude oil	1,084,513,000	26,374,000	2.4
Motor fuel	444,104,000	61,208,000	13.8
Kerosene	57,154,000	20,018,000	35.0
Gas and fuel oil	447,894,000	39,073,000	8.7
Lubricating oil	34,359,000	10,840,000	31.6

* Production of refined products embraces total output of U. S. refineries from both domestic and foreign crude oil.

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EXPORTS OF PETROLEUM AND PRODUCTS FROM UNITED STATES

(Thousands of Barrels of 42 U. S. Gallons)

Year	Crude oil	Refined products	Total
1913	5,407	46,238	51,645
1918	5,884	61,172	67,056
1919	6,253	56,505	62,758
1920	8,583	68,696	77,279
1921	9,552	60,763	70,315
1922	10,637	62,065	72,702
1923	17,210	82,848	100,058
1924	17,879	97,328	115,207
1925	13,155	98,592	111,747
1926	15,477	113,552	129,029
1927	15,843	115,399	131,242
1928	18,961	126,159	145,120
1929	26,394	127,156	153,550

Authority: U. S. Bureau of Foreign and Domestic Commerce.

VALUE OF EXPORTS OF PETROLEUM AND PRODUCTS FROM THE UNITED STATES

(Thousands of Dollars)

Year	Crude oil	Refined products	Total
1913	$9,052	$140,868	$149,920
1918	13,474	338,151	351,625
1919	15,359	338,391	353,750
1920	30,078	532,499	562,577
1921	21,598	376,108	397,706
1922	19,410	321,424	340,834
1923	23,287	338,061	361,348
1924	26,772	403,019	429,791
1925	24,282	435,739	460,021
1926	28,499	510,978	539,477
1927	25,944	429,663	455,607
1928	26,786	465,214	492,000
1929	37,800	493,373	531,173

Authority: U. S. Bureau of Foreign and Domestic Commerce.

EXPORTS OF REFINED PETROLEUM PRODUCTS FROM THE UNITED STATES

(Thousands of Barrels of 42 U. S. Gallons)

Year	Gasoline	Kerosene	Gas and fuel oil	Lubricating oil
1913	4,639	27,056	10,164	4,983
1918	13,545	11,820	29,642	6,165
1919	9,098	23,537	17,273	6,598
1920	15,637	20,881	22,538	9,643
1921	13,171	17,997	22,955	6,975
1922	14,157	21,489	18,479	7,940
1923	20,736	20,349	33,372	8,370
1924	28,967	21,961	37,248	9,104
1925	31,491	21,212	36,071	9,689
1926	43,852	21,789	38,347	9,346
1927	43,334	19,352	42,963	9,606
1928	51,752	21,847	41,573	10,817
1929	60,007	19,820	35,715	10,653

Authority: U. S. Bureau of Foreign and Domestic Commerce.

VALUE OF EXPORTS OF REFINED PETROLEUM PRODUCTS FROM THE UNITED STATES

(Thousands of Dollars)

Year	Gasoline	Kerosene	Gas and fuel oil	Lubricating oil
1913	$29,263	$73,748	$11,126	$30,041
1918	87,452	51,107	68,912	76,297
1919	64,354	120,564	35,291	86,058
1920	109,218	134,621	60,011	157,062
1921	135,585	95,293	51,426	93,803
1922	130,478	84,328	28,949	77,669
1923	142,034	77,706	40,223	77,891
1924	171,872	89,629	53,199	88,001
1925	202,673	85,657	54,135	92,521
1926	268,924	101,039	49,763	88,432
1927	209,839	79,303	49,802	88,843
1928	232,298	93,466	45,812	91,576
1929	266,904	83,788	37,200	102,899

Authority: U. S. Bureau of Foreign and Domestic Commerce.

CRUDE PETROLEUM EXPORTS FROM THE UNITED STATES

(Barrels of 42 U. S. Gallons)

Destination	1928	1929
Europe	556,421	323,489
Canada	15,431,230	22,412,181
Cuba	527,956	700,900
Japan	2,066,139	2,475,853
Other Countries	379,616	481,926
Total	18,961,362	26,394,349

Authority: U. S. Bureau of Foreign and Domestic Commerce.

GASOLINE EXPORTS

(Barrels of 42 U. S. Gallons)

Destination	1928	1929
Europe	33,500,084	37,494,022
North, Central, and South America	9,487,512	11,282,662
Far East, Australia	5,331,453	6,533,523
Africa	2,293,157	2,178,146
Other Countries	1,139,548	2,518,321
Total	51,751,754	60,006,674

GASOLINE EXPORTS FROM THE UNITED STATES BY COUNTRIES

(Barrels of 42 U. S. Gallons)

To	1928	1929
Belgium	1,273,745	1,350,046
Denmark	970,271	1,215,470
France	7,726,261	8,737,730
Germany	1,318,250	1,768,133
Irish Free State	170,753	239,387
Italy	1,464,690	1,319,198
Netherlands	1,884,855	1,849,792
Norway	287,155	450,820
Portugal	239,258	262,766
Spain	967,001	1,370,389
Sweden	1,561,523	1,412,512
United Kingdom	15,636,322	17,517,779
Canada	4,409,565	5,225,128
Panama	180,143	324,461
Mexico	294,508	558,365
Cuba	809,224	614,462
Dominican Republic	86,731	69,081
Argentina	1,782,798	2,291,323
Brazil	1,254,131	1,435,488
Uruguay	405,875	460,752
Other South America	264,537	303,602
China, Hong Kong, and Kwantung	244,581	503,299
Japan	737,723	912,957
Philippine Islands	377,428	462,536
Australia	2,751,815	3,403,728
New Zealand	1,219,906	1,251,003
British South Africa	931,603	849,865
British West Africa	348,512	279,730
French Africa	706,686	641,138
Morocco	134,242	126,100
Portuguese Africa	94,831	135,421
Spanish Africa	77,283	145,892
Other countries	1,139,548	2,518,321
Total	51,751,754	60,006,674
In bulk	47,342,401	54,497,753
In containers	4,409,353	5,508,921

Authority: U. S. Bureau of Foreign and Domestic Commerce.

KEROSENE EXPORTS

Destination	1928	1929
Europe	9,597,092	8,546,914
North, Central, and South America	1,869,392	2,198,135
Far East, Australia	8,921,600	7,184,511
Africa	1,058,263	1,260,591
Other countries	400,286	630,201
Total	21,846,633	19,820,352

KEROSENE EXPORTS FROM THE UNITED STATES BY COUNTRIES

(Barrels of 42 U. S. Gallons)

To	1928	1929
Belgium	296,373	222,208
Denmark	526,492	647,499
France	1,669,930	1,254,769
Germany	838,610	736,593
Italy	160,039	170,830
Netherlands	1,599,226	1,382,522
Norway	262,775	252,027
Portugal	356,192	248,109
Spain	101,824	88,451
Sweden	460,700	426,559
United Kingdom	2,944,533	2,793,847
Other Europe	380,398	323,500
Canada	150,063	120,392
Central America	45,142	386,969
West Indies, Bermudas	178,886	168,308
Argentina	189,773	201,088
Brazil	649,969	602,005
Uruguay	180,732	195,901
British India	474,827	523,472
China, Hong Kong, and Kwantung	4,769,331	4,014,738
Netherlands East Indies	174,162	247,492
French Indo China	75,763	93,671
Japan	2,371,610	1,304,294
Philippine Islands	360,405	461,952
Australia	993,463	908,149
New Zealand	176,866	154,215
British Africa	669,191	748,468
French Africa	287,788	404,073
Portuguese Africa	101,284	108,050
Other countries	400,286	630,201
Total	21,846,633	19,820,352
In bulk	16,289,314	14,364,269
In containers	5,557,319	5,456,083

Authority: U. S. Bureau of Foreign and Domestic Commerce.

GAS AND FUEL OIL EXPORTS
(Barrels of 42 U. S. Gallons)

Destination	1928	1929
Europe	9,499,805	8,067,457
North, Central, and South America	21,754,308	18,703,405
Far East, Australia	7,785,994	7,767,284
Africa	79,044	7,018
Other countries	2,454,034	1,169,620
Total	41,573,185	35,714,784

GAS AND FUEL OIL EXPORTS FROM THE UNITED STATES BY COUNTRIES
(Barrels of 42 U. S. Gallons)

To	1928	1929
Belgium	433,935	490,215
Denmark	597,528	502,042
France	578,477	249,309
Germany	1,793,140	1,350,809
Italy	402,800	311,191
Netherlands	884,301	887,536
Norway	106,747	211,035
Spain	153,242	210,363
Sweden	146,894	261,679
United Kingdom	4,402,741	3,593,278
Canada	2,386,682	2,125,648
Panama	5,188,569	3,331,501
Mexico	1,218,770	1,741,217
Cuba	2,025,707	2,568,557
Other West Indies and Bermudas	624,006	1,426,849
Argentina	2,113,870	505,585
Brazil	887,428	503,238
Chile	6,328,693	6,064,305
Other South America	980,583	436,505
China, Hong Kong	1,131,086	933,765
Japan	5,114,192	5,171,687
Philippine Islands	592,431	886,688
New Zealand	948,285	775,144
French Africa	79,044	7,018
Other countries	2,454,034	1,169,620
Total	41,573,185	35,714,784
Fuel or bunker oil for vessels in foreign trade, not included in above.		
On American vessels	23,411,692	24,963,075
On foreign vessels	27,814,086	27,314,797
Total	51,225,778	52,277,872

Authority: U. S. Bureau of Foreign and Domestic Commerce.

Lubricating Oil Exports from the United States by Countries

(Barrels of 42 U. S. Gallons)

	1928	1929
Red and pale lubes		
To		
Belgium	757,913	664,693
Denmark	107,281	108,693
France	1,014,401	1,101,919
Germany	859,190	866,531
Italy	263,414	176,878
Netherlands	208,504	187,155
Spain	54,483	51,517
Sweden	98,988	88,105
United Kingdom	1,320,965	1,185,680
Other Europe	88,918	156,987
Canada	303,436	388,904
Mexico	47,525	39,807
Cuba	47,110	60,792
Argentina	125,442	139,259
Brazil	149,441	113,145
Chile	37,741	36,346
Other South America	70,871	64,592
British India	388,682	268,810
China, Hong Kong, and Kwantung	254,485	260,615
Netherlands East Indies	39,156	60,310
Japan	198,870	214,322
Philippine Islands	70,354	61,387
Australia	183,963	277,936
New Zealand	42,798	58,336
British Africa	33,116	49,649
Egypt	38,507	74,245
Portuguese Africa	14,266	19,857
Other countries	124,936	135,468
Total red and pale	6,944,751	6,911,938
Black	1,029,224	
Cylinder		
To		
Belgium	120,209	134,285
Denmark	12,120	22,549
France	385,722	372,279
Germany	438,402	331,227
Italy	213,086	147,348
Netherlands	74,102	54,653
Norway	6,367	8,447
Spain	31,506	43,825
Sweden	20,737	17,959
United Kingdom	551,931	578,790
Canada	123,967	135,691
Mexico	34,581	30,137
Cuba	29,899	27,751
Argentina	85,965	137,889
Brazil	92,828	131,885
Chile	19,506	29,984
Other South America	37,667	39,529
British India	43,379	63,769
China, Hong Kong, and Kwantung	17,953	23,014
Netherlands East Indies	10,299	17,631
Japan	48,832	57,245
Australia	143,927	131,266
New Zealand	30,676	28,770
British Africa	74,850	72,598
Egypt	43,082	30,476
Portuguese Africa	29,349	22,880
Other countries	122,530	183,391
Total cylinder	2,843,472	2,875,268
Total lubricating oil	10,817,447	10,653,014
Mineral spirits (substitute for turpentine) Gal.	2,352,714	2,529,996
Insulating or transformer oils Gal.	4,231,038	4,330,494
Light lubricating oils in small packages Gal.	544,908	797,735
Lubricating greases Lb.	108,111,834	116,692,291
Paraffin wax Lb.	392,651,969	319,231,709
Petroleum asphalt Ton	439,609	427,941
Petroleum coke Ton	128,688	115,820
Petroleum residuum Bbl.	62,506	34,958

Authority: U. S. Bureau of Foreign and Domestic Commerce.

THE PETROLEUM INDUSTRY OF THE UNITED STATES

PETROLEUM IN THE UNITED STATES

The petroleum industry has made greatest progress, just as it has achieved greatest production, in the United States. Since production has been recorded, this country has supplied more than 65 per cent of all the oil brought to the surface in the world, and has probably consumed about 70 per cent.

The reasons for American leadership are obvious. First, Nature richly endowed this country with oil resources. Second, generally speaking, petroleum in the United States is accessible and lends itself to quick and efficient methods of transportation. Third, American ingenuity and enterprise have found the oil, developed methods of producing it, built pipe lines and refineries and, not less important, created great consuming agencies for petroleum products, such as the automobile. Fourth, under American laws governing property ownership, and under the impetus of competition, petroleum development in this country has been free and largely unhampered.

Flush production of American oil began almost as soon as the Drake well was completed. Thousands of competing wells were drilled in the immediate area, and for more than 30 years thereafter Pennsylvania and other eastern states produced the greater part of the country's oil. As the demand for petroleum products increased, however, the industry's producing operations were broadened.

Crude oil is produced in 19 states—Arkansas, California, Colorado, Illinois, Indiana, Kansas, Kentucky, Louisiana, Michigan, Montana, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, West Virginia, and Wyoming. Texas currently accounts for 37 per cent of the

total production, Oklahoma for 25 per cent, and California for 24 per cent. These three states, with Kansas, Arkansas, Louisiana, and Wyoming, are producing 97 per cent of the country's annual output. Production from Texas alone is equal nearly to that of all foreign countries combined.

Geographically, the country's main producing districts are the Eastern, Mid Continent, Gulf Coast, Rocky Mountain, and California. The oldest is the Eastern, a great V-shaped geological depression between the Appalachian and Ozark Mountains. The greatest production has come from the Appalachian field, which includes Kentucky, West Virginia, Pennsylvania, New York, and Eastern Ohio; but while this territory in 1900 was producing 56 per cent of the country's oil, today its output represents only 5 per cent, a decline indicative of the comparatively short life of producing fields.

The Mid Continent district, embracing Oklahoma, Kansas, all of Texas and Louisiana except the Gulf Coast area, and Arkansas, produces about 60 per cent of the American output. The Gulf Coast district, which came into prominence in 1901, contributes about 8 per cent. Wyoming, Montana, Colorado, and New Mexico, comprising the Rocky Mountain district, yield 3 per cent, and California supplies the remaining 24 per cent.

BIRTH OF THE PETROLEUM INDUSTRY

Although modern uses of petroleum are numbered in thousands, development of the petroleum industry, and particularly its spectacular development in the United States, primarily was due to a demand for crude oil as a source of medicines and illuminants. Its production and utilization on a large scale, curiously interwoven with the history of the American nation, was a direct outgrowth of petroleum's association with salt or brine deposits.

To the young and growing nation, compelled to rely for its salt supply upon the brine wells of Pennsylvania, Ohio,

West Virginia, Kentucky, and Tennessee, the dark, evil-smelling liquid which occasionally flowed from these wells was not only a nuisance, but a handicap to the recovery of salt. There was no place for it in the scheme of things. It annoyed the salt well operators, and sometimes led to the abandonment and condemnation of an otherwise valuable salt property.

But there were a few far-sighted business men who sought to put this nuisance to commercial use. Among them was the enterprising Samuel M. Kier. With a few others, he sold crude oil for medicinal purposes, advertising his product, "Kier's Rock Oil," by imitations of an American greenback bearing a vignette showing his plant at Tarentum, Pa., with the derricks used in boring and pumping brine wells. In the summer of 1857 George H. Bissell, of New Haven, Conn., head of a syndicate of business men owning 100 acres of land near Titusville, Pa., saw one of Kier's rock oil greenbacks in the window of a Broadway, New York, drug store. Bissell had received a favorable report from a college professor who had been experimenting with crude oil as a source of illuminant, and Bissell's syndicate thereupon decided to develop its property as oil land, using methods employed in drilling for brine. The syndicate engaged Edwin Laurencine Drake to superintend the work.

Colonel Drake, now known as the founder of the modern petroleum industry, was 40 when, in May 1858, he gave up his job as a railroad conductor to become director and superintendent of the Titusville properties of the Pennsylvania Rock Oil Company and the Seneca Oil Company. It was nearly a year before he found an experienced and reliable well driller, William A. Smith; and June had come before Smith and his two sons could obtain or build drilling machinery and equipment. Rock was struck when the hole was down 36 feet; drilling was delayed for lack of proper tools, and "Drake's Folly" became the joke of the countryside.

But late on a sultry Saturday afternoon—August 27, 1859—" Uncle Billy " Smith and his son, Sam, drew their iron bit from the 69½-foot hole in the Titusville creek bed and found a black, oily liquid bubbling nearly to the top of the well. Using an old pitcher pump, father and son jubilantly raised several barrels of oil. Then the father mounted his mule and galloped a mile to tell the joking crowd at the Titusville general store that " Drake's Folly " was a dream come true.

FIRST ERA OF LIGHT

The occasion represented more than merely the realization of a dream; it was the birth of a new industry and of the first era of light. For years scientists had been seeking a new source of illuminant to replace whale (or sperm) oil, demand for which was exceeding the supply, and to supplant the tallow dip, never a satisfactory light. Inventors had produced, among other compounds, an illuminant made of turpentine and alcohol. James H. Young, a Scotchman, had obtained oil from Scotch shales and had refined it for use in crude lamps. In 1854 an American chemist, Dr. Abram Gessner, had patented an illuminating oil called kerosene, which he distilled from coal. In fact, at the time the Drake well was brought in, some 50 companies were producing oil from shale and coal on a small scale. And so, in a way, the market was ready for the product.

With the Drake well demonstrating its success as a producer, there was an " oil boom " in Pennsylvania, the first in history. Mushroom cities sprang up, the most famous being Pithole City, a few miles from Titusville. An enormous number of wells were drilled, many of which produced oil. So great was production, moreover, that the market price of oil fell from $21 a barrel to a few cents a barrel.

TRANSPORTATION SOLVED BY PIPE LINE, TANK CAR, AND TANKER

Transportation became the first major problem of the new industry. Thousands of teamsters and hundreds of boats on Oil Creek were engaged in this traffic, and later railroads were extended into the oil regions. At first oil was moved in barrels by road, water, and rail, creating a demand for barrels that overtaxed cooperage facilities. Five years after the Drake well, Charles P. Hatch conceived the idea of the tank car, and within a short time long lines of tank cars had replaced barrel-laden flat cars on railroad sidings. In 1865 VanSyckel built the first pipe line in the oil region—a five-mile conduit—crude, but a decided improvement in transportation methods. By 1874 work was begun on a 60-mile pipe line to Pittsburgh, and four years later a syndicate was organized to lay a line across the Alleghenies to tidewater. From the time the first pipe line was built, construction and operation were menaced by opposition from teamsters, boatmen, and railroad men. Sometimes the opposition reached the status of open warfare; certainly it involved a number of legal skirmishes; but the pipe line survived because other means of transportation utterly were unable to handle the flood of oil, and without the pipe line oil literally would have backed up into the wells for lack of suitable outlet.

Oil transportation soon was established on an international scale, for Europe was seeking to purchase both crude and refined petroleum products. Again the barrel was incapable of meeting the transportation problem, and the evolution of the tank ship began. The first appeared about 1869, the Belgian ship, "Charles," being equipped with iron tanks fitted with pumps to facilitate loading. By 1878 the business of carrying oil in iron ships specially built for that purpose, or in converted vessels like the "Charles," was definitely established. Petroleum had become the product of a world industry.

DEVELOPMENT OF THE AMERICAN PETROLEUM INDUSTRY *

Statistics reveal how rapidly the petroleum industry has grown and on what a gigantic scale it operates in the United States.

Seventy-one years ago this country had the Drake well, 69½ feet deep, and producing a few barrels of oil. Today there are more than 300,000 wells, some of them nearly 10,000 feet deep, located in 19 states, producing more than 2,500,000 barrels of oil and hundreds of millions of cubic feet of natural gas daily.

New wells are drilled at the rate of more than 20,000 a year and at an annual expenditure exceeding $500,000,000.† The average well costs around $25,000 to complete, but the cost of individual wells may run as high as $250,000.

More than 400 refineries, located in 30 states, and representing 85 per cent of the world's refinery capacity, operate day and night to transform a billion dollars' worth of crude oil into refined products worth several times that amount. Refined petroleum products are fifth in total value among this country's manufactured goods.

TRANSPORTATION EQUIPMENT OF TODAY

The original pipe line, five miles long, has become a vast underground system of trunk and gathering lines more than 100,000 miles in length. In recent years it has been augmented by the construction of new lines carrying gasoline from refineries, and natural gas from the oil fields, to city markets. Tank farms and bulk terminals provide storage facilities for millions of barrels of petroleum and its products.

Rapid and efficient transportation is assured by the operation of some 150,000 tank cars, 95 per cent of them owned

* For "Growth and Competition in the Petroleum Industry," see also "Petroleum Facts and Figures," first edition, p. 28.

† For "Cost of Drilling Oil Wells," see also "Petroleum Facts and Figures," second edition, p. 114.

by oil companies, and enough tank ships to make up 17 per cent of the United States Merchant Marine and to pay 20 per cent of all tolls received yearly by the Panama Canal. Thousands of oil barges, for use on inland waterways, and hundreds of thousands of tank trucks, carrying refined products, especially over the country's highways, augment the industry's transportation system.

MARKETING ON A WORLD-WIDE BASIS

Markets for American petroleum products have been established around the world. In this country alone there are more than 350,000 service stations supplying fuel and lubricants for the nation's 27,000,000 motor vehicles. Storage terminals, bunkering stations, and numerous other outlets provide refueling facilities for the half of the world's merchant shipping that uses oil for fuel, for virtually all the vessels of war, and for oil-burning locomotives, heating plants, and other consuming agencies.

In marketing, as in its other branches, the American petroleum industry talks in large figures. It handles not only the billion barrels of crude oil it produces yearly, but in addition some 400,000,000 barrels of gasoline, 60,000,000 barrels of kerosene, 400,000,000 barrels of gas and fuel oils, 34,000,000 barrels of lubricants, and a variety of other products. It has built up an export trade amounting to more than $500,000,000 annually, or one-tenth of the nation's total foreign business. It imports, chiefly for refining and export, some 80,000,000 barrels of crude oil yearly.

IMPORTANCE OF INDUSTRY TO GENERAL PROSPERITY

In the scope of its operations, the American petroleum industry probably is second only to agriculture. It employs more than 2,000,000 workers. It has an invested capital of more than $12,000,000,000, and its investors number more than 2,250,000.

The industry pays more than $100,000,000 annually in taxes.* Not only are its products taxed from the crude to the finished state, but even in the ground before production and in the market after delivery to the consumer. At the present time consumers are paying state taxes totalling some $500,000,000 annually on gasoline alone.

The petroleum industry is one of the largest purchasers and users of steel, iron, motor vehicles, pipe, stationary engines, lumber, rope, paints, rubber, brass, tin, and chemicals. Its orders for tank ships make it the second largest customer of the shipyards. It is the largest purchaser of tank cars, and it ships a greater tonnage of manufactured products by rail than any other industry.

THE PETROLEUM INDUSTRY'S PROBLEMS

It was a sudden demand for a nuisance, crude oil, that led to the founding of the petroleum industry. And in 1910 it was a sudden demand for a nuisance by-product, gasoline, that led to its unprecedented expansion and development.

Motor vehicles, with an enormous appetite for fuel and lubricants, increased rapidly in number. The World War stimulated the demand for fuel oil for industrial and marine uses. Aviation grew from a dream into an industry with a craving for more gasoline and more oil. The oil burner was transformed from a novelty into an accepted means of providing domestic and industrial heat. New uses were found for refined petroleum products. New markets developed at home and abroad. The age of machinery definitely established its dependence upon the products of petroleum.

The petroleum industry responded. Search for new oil fields became vigorous and successful. Old refineries were enlarged, and new refining plants were built. Old refining processes were discarded or changed. Pipe line, tank ship, and other transportation facilities were extended. Filling

* For "Taxation of the Oil Industry and Petroleum Products," see also "Petroleum Facts and Figures," second edition, p. 65.

stations and curbside pumps were built along the highways by tens of thousands.

Never has an industry been called upon to make so great a capital outlay within so short a time as has the petroleum industry during the past two decades. And while its tremendous growth enabled it to meet every demand made upon it, that same tremendous growth has been responsible for the " growing pains " which have become the industry's problems of today. Yet the problems are not entirely the problems of the industry; they are the problems of the American people, the problems of a nation dependent upon a continued, economical, and inexhaustible supply of an irreplaceable natural resource.

It was perhaps only natural that an industry called upon under the urgency of sudden demand—and much of it a wartime demand that brooked no delay—should in expanding production of its raw material 400 per cent in less than a score of years perform its task too well and create a condition of overproduction. And that exactly is what happened. New oil areas were located. New wells were drilled. New oil was brought to the surface. Competitive drilling, forced alike by man-made and nature's law; natural forces, causing wells to flow regardless of immediate need; individual enterprise, resenting any effort to restrain ambition no matter how misdirected; inexperience, causing excesses and waste natural to a young industry—all these, combined with a will to produce and capital to finance such production, soon caused a flood of oil not unlike that which inundated the first American field a half century before, but on a nationwide, an international scale.

OVERPRODUCTION AND THE NEED FOR CONSERVATION

Overproduction in the field was accompanied by overproduction in the refining branch of the industry. Capacity began to surpass demand. Highly efficient refining processes produced constantly increasing proportions of products in demand from given amounts of crude oil, and intensified the overproduction problem. The flood of petro-

leum products spread to the market, necessitating dumping, unloading, and diversion of a valuable commodity to inferior uses, causing waste of a precious national resource.

There arose public demand for restoration of order. The industry itself realized its own needs, and in 1919 created the American Petroleum Institute, an outgrowth of the cooperative work of the National Petroleum War Service Committee, to afford a means of cooperation between industry and government in matters of national concern, to promote the interests of the industry, to foster trade in petroleum products, and to promote the study of arts and sciences connected with the petroleum industry. In 1924 President Coolidge constituted a Federal Oil Conservation Board to study the government's responsibilities in conservation of petroleum resources and to enlist the full cooperation of the petroleum industry.

" The supremacy of nations may be determined by the possession of available petroleum and its products," the President explained, adding that " overproduction in itself encourages cheapness, which in turn leads to wastefulness and disregard of essential values," and that " the problem of a future shortage in fuel and lubricating oil, not to mention gasoline, must be avoided."

CONSERVATION ADOPTED AS A PRACTICE

Conservation of national petroleum resources thus came into being as a policy, and in recent years has been largely adopted by the industry as a practice, especially since it is a means of checking overproduction. More efficient methods of producing and handling oil in the field have been developed. Natural gas, once a waste product, is being diverted to useful channels. Cooperative agreements between operators have replaced wasteful competition in developing new oil fields. Unitization, the practice of unifying the ownership and control of oil pools for development and operation by an agency representing holders of interests therein, has been accepted in many new fields. Pro-ration of runs, or curtailment of output of flush fields, under

the guidance of various state commissions, has been an added factor in controlling the flow of oil and holding production as nearly as possible to the level of current demand. Enabling laws also have been sought, but so far the multitude of factors arising from differing local and general conditions have precluded enactment except in certain instances, such as the California gas conservation law, which prohibits unreasonable waste of natural gas in connection with the production of oil and, therefore, tends to restrain unnecessary output of oil.

Conservation has been furthered in the refining branch of the industry, chiefly through the development of more efficient distillation processes assuring greater recovery of refined products from the crude. Curtailment of overproduction has not been as successful as in the producing branch because of many adverse factors; but slow, substantial progress has been made. Refinery operations are dependent upon three variable factors of demand—number of motor vehicles in operation, business conditions, and the weather—none of which accurately can be estimated in advance. However, since refining has been developed to the point where production is so great and so rapid as to obviate the necessity of carrying large stocks of refined products, effort is being made to operate on a demand basis. The Federal Oil Conservation Board has suggested that refineries adopt a six-day week working basis, in effect curtailing output about 15 per cent.

Overproduction affected the marketing branch largely through an excess and duplication of retail outlets, particularly the roadside filling and service stations catering to the motorists' demands for gasoline and lubricating oils. Economic abuses have been recognized in this field, and the work of correcting them has started through adoption of a National Code of Practices for Marketing Refined Petroleum Products, designed to re-establish fair competition for dealers and good service for the buying public.

These general, as well as the technical, problems largely have been studied cooperatively, an undertaking that a few

years ago was considered not only improbable, but impossible in an industry that surpassed all others in the bitterness of competition. But the American Petroleum Institute and a number of other organizations have provided forums wherein those active in the industry can discuss their mutual problems; and success so far achieved has led to general adoption of the policy of frequent conferences and cooperative work. The Institute alone, within its Divisions of Production, Refining, and Marketing, has thousands of field men, technical men, and business men now engaged in such cooperative activity. The results of their studies and their findings frequently are compiled and published for the benefit of the entire industry.

PETROLEUM LEADS IN GAINS OF MINERALS

Of all the mineral industries, the production of petroleum shows the greatest gains in recent years. According to a compilation made by the U. S. Department of Commerce (with 1923-1925 average as the basis), the index of production of petroleum in 1929 shows a gain of 37 per cent, with copper production showing the next largest gain of 27 per cent, and zinc a gain of 14 per cent. The average of all these minerals showed an increase of 15 per cent.

INDEX OF PRODUCTION OF MINERALS, BY PRODUCTS

[Adjusted for seasonal variations. 1923-1925 average = 100]

Annual indexes	All minerals	Bituminous coal	Anthracite coal	Crude petroleum	Iron ore shipments	Copper	Zinc	Lead	Silver
1919	77	88	109	52	88	77	.....	.....	.....
1920	89	108	110	61	114	80	87	.....	.....
1921	70	79	112	64	40	30	39	66	84
1922	74	80	69	76	80	63	68	77	87
1923	105	108	115	100	114	93	96	88	102
1924	96	92	108	97	82	100	97	102	100
1925	99	100	77	103	104	106	107	111	98
1926	108	110	105	104	113	110	116	114	95
1927	107	99	99	121	95	105	111	112	93
1928	106	94	95	122	104	115	112	106	88
1929	115	100	95	137	121	127	114	113	94

Authority: Department of Commerce, Survey of Current Business.

STATES WHERE PETROLEUM IS PRODUCED AND REFINED

More states in the United States have a significant share in the petroleum industry than there are cotton states or wheat states, or corn states, or steel states, or textile states.

Nineteen states now produce petroleum. The refining of petroleum has spread to 29 states.

States Where Petroleum Is Produced and Refined

	Production 1929		Rated refinery capacity January 1, 1930	
	Barrels	Per cent of total	Barrels per day	Per cent of total
Arizona	.....	....	1,000	0.03
Arkansas	25,076,000	2.49	41,500	1.14
California	292,037,000	29.04	888,730	24.45
Colorado	2,298,000	0.23	4,100	0.11
Georgia	.....	....	5,000	0.14
Illinois	6,304,000	0.63	137,500	3.78
Indiana	977,000	0.10	160,000	4.40
Iowa	.....	....	3,500	0.10
Kansas	42,875,000	4.26	130,000	3.58
Kentucky	7,776,000	0.77	28,260	0.78
Louisiana	20,229,000	2.02	217,380	5.98
Maryland	.....	....	50,000	1.38
Massachusetts	.....	....	42,000	1.16
Michigan	4,354,000	0.43	13,500	0.37
Missouri	.....	....	16,000	0.44
Montana	3,183,000	0.32	18,800	0.52
New Jersey	.....	....	307,500	8.46
New Mexico	1,689,000	0.17	2,550	0.07
New York	3,346,000	0.33	34,500	0.95
Ohio	6,708,000	0.67	86,280	2.37
Oklahoma	253,704,000	25.23	287,500	7.91
Pennsylvania	11,805,000	1.17	225,700	6.21
Rhode Island	.....	....	11,500	0.32
South Carolina	.....	....	15,000	0.41
Tennessee	19,000	....	.....	....
Texas	298,441,000	29.68	773,275	21.27
Utah	.....	....	6,000	0.16
Virginia	.....	....	1,500	0.04
West Virginia	5,587,000	0.55	14,500	0.40
Wyoming	19,190,000	1.91	111,750	3.07
Totals	1,005,598,000	100.00	3,634,825	100.00

Authority: U. S. Bureau of Mines.

OIL PRODUCTS SET THE PRODUCTION PACE

Among the principal manufactured commodities, according to the U. S. Department of Commerce, the production of petroleum products shows the largest gain in 1929, with an increase of 68 per cent over the average production computed for the years 1923-1925. Automobiles and rubber tires showed the next largest increase of 35 per cent.

INDEX OF PRODUCTION OF MANUFACTURES, BY GROUPS

[Adjusted for seasonal variations. 1923-1925 average = 100]

Annual indexes	All manufactures	Iron and steel	Textiles	Food products	Paper and printing	Lumber	Automobiles	Leather and shoes	Cement, brick, and glass	Non-ferrous metals	Petroleum refining	Rubber tires	Tobacco manufactures
1919	84	82	92	93	76	79	53	104	53	67	54	...	83
1920	86	99	84	84	86	79	55	95	68	78	63	...	86
1921	66	46	88	84	66	68	41	91	62	39	64	55	85
1922	87	83	99	94	85	89	66	103	78	69	74	78	88
1923	101	105	105	99	95	99	102	110	95	94	86	86	96
1924	94	88	91	103	99	96	90	94	95	99	99	98	99
1925	105	106	104	98	106	105	107	96	110	107	115	116	105
1926	108	113	104	97	115	100	111	98	113	112	125	116	112
1927	106	104	113	96	113	94	89	103	109	109	136	120	118
1928	111	119	107	98	117	89	113	102	120	115	152	144	124
1929	119	129	115	97	...	...	135	105	132	125	168	135	134

Authority: Department of Commerce, Survey of Current Business.

PETROLEUM REFINING FIFTH IN VALUE OF MANUFACTURES

The petroleum refining industry, according to the Census of Manufactures, ranked fifth in the value of products manufactured in 1927. The wholesale value of petroleum products in that year was $2,142,648,503. The industry of slaughtering and meat packing led with a wholesale value of $3,057,215,718; and motor vehicle manufacture ranked second, with a wholesale value of vehicles of $2,848,442,843.

WHOLESALE VALUE OF MANUFACTURES

	Wholesale value 1927
1. Slaughtering and meat packing	$3,057,215,718
2. Motor vehicles, not including motorcycles	2,848,442,843
3. Iron and steel: steel works and rolling mills	2,779,840,238
4. Foundry and machine-shop products, not elsewhere classified	2,259,794,443
5. Petroleum refining	2,142,648,503
6. Electrical machinery, apparatus, and supplies	1,637,307,035
7. Printing and publishing, newspaper and periodical	1,577,866,988
8. Cotton goods	1,567,400,612
9. Clothing, women's, not elsewhere classified	1,494,401,044
10. Bread and other bakery products	1,378,629,764

Authority: Census of Manufactures, 1927.

CENSUS OF PETROLEUM REFINING, 1927

The U. S. Department of Commerce, in its biennial census of manufactures taken in 1928, reports that establishments engaged primarily in petroleum refining in 1927 showed products valued at $2,142,648,503, a decrease of 9.8 per cent as compared with $2,376,656,556 for 1925, the last preceding census year.

VALUE OF PETROLEUM PRODUCTS, 1927 AND 1925

	1927	1925
Gasoline and other light products of distillation	$1,102,154,007	$1,265,284,305
Illuminating oils	147,925,073	161,880,676
Fuel oils, distillates and gas oils, etc	456,959,052	488,957,806
Partially refined oils sold for re-running	62,210,130	65,305,061
Lubricating oils	244,629,175	252,104,578
Liquid asphaltic road oils	9,307,838	12,511,739
Residuum or tar	5,117,722	5,581,753
Greases, including petrolatum, etc	12,961,205	13,920,627
Paraffin wax	23,432,260	30,590,464
Acid oil	1,848,797	1,139,310
Asphalt, other than liquid asphalt	37,884,108	30,460,927
Coke (petroleum)	7,169,596	6,437,483
Other refinery products*	22,323,725	29,894,338
Aggregate value	$2,133,922,688	$2,364,069,067

* Oils in process, still gas, wax tailings, etc.

SUMMARY FOR PETROLEUM REFINING INDUSTRY, 1927 AND 1925

	1927	1925	Per cent of increase or decrease (—)
Number of establishments	354	359	—1.4
Wage earners (average for the year) *	71,234	65,324	9.0
Wages †	$113,716,705	$104,645,391	8.7
Cost of materials, supplies, containers for products, fuel, and purchased power, total †	$1,752,997,043	$1,889,678,019	—7.2
Materials, supplies, and containers	$1,649,288,320	‡	.....
Fuel and power	$103,708,723	‡	.....
Products, total value †	$2,142,648,503	$2,376,656,556	—9.8
Petroleum products and by-products, value	$2,133,922,688	$2,364,069,067	—9.7
Other products, value	$8,725,815	$12,587,489	—30.7
Value added by manufacture §	$389,651,460	$486,978,537	—20.0
Horsepower	552,651	393,753	40.4

* Not including salaried employees.

† The amount of manufacturers' profits cannot be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest on investment, rent, depreciation, taxes, insurance, and advertising.

‡ Not reported separately.

§ Value of products less cost of materials, supplies, containers for products, fuel, and purchased power.

PETROLEUM AND THE FARMER

The sources of power now available on farms in the United States, in addition to human labor and animals, are gasoline engines, including tractors, trucks, and automobiles; steam engines, and electric, wind, and water motors. All these sources draw on petroleum for lubrication. Stationary engines, tractors, trucks, and automobiles draw on the petroleum industry for gasoline and kerosene.

MOTOR VEHICLES ON FARMS, DECEMBER 31, 1929

State	Passenger cars	Trucks	Motor vehicles	Tractors
Texas	357,000	42,600	399,600	33,468
Ohio	229,500	42,500	272,000	52,166
Illinois	229,000	34,000	263,000	65,716
Iowa	230,000	28,400	258,400	59,038
Pennsylvania	198,000	42,000	240,000	34,728
Wisconsin	198,500	35,000	233,500	52,636
New York	187,500	43,500	231,000	45,139
Minnesota	198,000	28,500	226,500	41,858
Missouri	196,000	23,900	219,900	19,820
Kansas	185,000	22,800	207,800	52,000
Indiana	181,000	26,600	207,600	35,439
Michigan	179,500	21,600	201,100	35,409
California	160,000	35,000	195,000	50,000
Oklahoma	165,500	17,500	183,000	21,253
Nebraska	148,000	20,000	168,000	32,383
North Carolina	136,500	25,100	161,600	14,394
Virginia	115,000	24,000	139,000	11,188
Georgia	108,500	15,400	123,900	7,304
Kentucky	108,500	11,300	119,800	8,641
Alabama	97,500	13,500	111,000	4,486
Tennessee	89,500	9,100	98,600	8,408
Mississippi	83,000	15,500	98,500	3,356
South Dakota	87,500	10,500	98,000	27,226
Arkansas	86,000	8,400	94,400	6,000
Washington	79,000	15,000	94,000	7,085
North Dakota	83,000	10,300	93,300	27,318
South Carolina	76,500	8,300	84,800	4,839
Montana	64,000	8,500	72,500	9,631
Oregon	62,000	8,500	70,500	9,253
Louisiana	60,000	10,200	70,200	5,500
West Virginia	61,000	7,500	68,500	3,359
Colorado	57,800	9,600	67,400	9,356
Florida	46,000	14,500	60,500	5,521
Maryland	50,000	9,500	59,500	6,948
Idaho	56,000	2,900	58,900	4,000
New Jersey	31,500	12,400	43,900	7,689
Massachusetts	30,700	13,000	43,700	4,251
Maine	32,500	7,100	39,600	3,229
Utah	31,000	4,000	35,000	1,345
Connecticut	20,500	6,500	27,000	2,692
Vermont	22,300	3,800	26,100	3,021
Wyoming	21,000	2,800	23,800	2,034
New Hampshire	18,700	4,600	23,300	1,037
New Mexico	19,500	3,600	23,100	1,834
Arizona	13,500	2,700	16,200	1,907
Delaware	10,000	3,200	13,200	1,320
Nevada	5,000	1,000	6,000	323
Rhode Island	4,300	1,000	5,300	614
United States	4,910,300	767,200	5,677,500	846,162

MOTOR VEHICLES ON FARMS—REGISTRATIONS BY YEARS

United States	Passenger cars	Trucks	All motor vehicles
1919	2,146,512	139,169	2,285,681
1922	3,146,860	266,140	3,413,000
1923	3,289,630	285,250	3,574,880
1924	3,453,159	367,926	3,821,085
1925	3,853,526	478,956	4,332,482
1926	4,028,640	499,782	4,528,442
1927	4,408,470	598,654	5,007,124
1928	4,729,600	697,300	5,426,900
1929	4,910,300	767,200	5,677,500

Authority: *The Farm Journal.*

TRACTORS ON THE FARM, DECEMBER 31, 1929

State	Tractors	State	Tractors
Alabama	4,486	New Jersey-Delaware-Maryland	15,957
Arizona	1,907	New Mexico	1,834
Arkansas	6,000	New York	45,139
California	50,000	North Carolina	14,394
Colorado	9,356	North Dakota	27,318
Florida	5,521	Ohio	52,166
Georgia	7,304	Oklahoma	21,253
Idaho	4,000	Oregon	9,253
Illinois	65,716	Pennsylvania	34,728
Indiana	35,439	South Carolina	4,839
Iowa	59,038	South Dakota	27,226
Kansas	52,000	Tennessee	8,408
Kentucky	8,641	Texas	33,468
Louisiana	5,500	Utah	1,345
Michigan	35,409	Virginia	11,188
Minnesota	41,858	Washington	7,085
Mississippi	3,356	West Virginia	3,359
Missouri	19,820	Wisconsin	52,636
Montana	9,631	Wyoming	2,034
Nebraska	32,383		
Nevada	323		
New England*	14,844	United States	846,162

* To more nearly equalize areas, New England is combined, also New Jersey, Delaware, and Maryland.

Authority: *The Farm Journal.*

GASOLINE PRICES LOW COMPARED WITH OTHER COMMODITIES

The average wholesale prices of gasoline in the United States in 1929 were lower than in 1913, the pre-war year, according to the index figures for average wholesale prices of all commodities published by the U. S. Department of Labor. With 1926 as a basis, the index number for gasoline in 1929 was 82.9, compared with 84.7 in 1913.

Gasoline sold considerably cheaper than the average of all commodities, which in 1929 was 96.5. In other words, the 1926 dollar would purchase $1.171 worth of gasoline, as against 95 cents' worth of commodities generally.

Comparing gasoline prices with the prices of other commodities in general use shows that it sold on a comparative basis in 1929 cheaper than eggs, sugar, butter, milk, bread, and shoes.

INDEX NUMBERS OF WHOLESALE PRICES OF COMMODITIES, 1926 = 100

(Average for the Year)

Year	Farm products	Foods	Textile products	Fuel and lighting	Metal and metal products	Building materials	Chemicals and drugs	House furnishings	Miscellaneous	All commodities	Gasoline
1913.....	71.5	64.2	57.3	61.3	90.8	56.7	80.2	56.3	93.1	69.8	84.7
1914.....	71.2	64.7	54.6	56.6	80.2	52.7	81.4	56.8	89.9	68.1	72.5
1915.....	71.5	65.4	54.1	51.8	86.3	53.5	112.0	56.0	86.9	69.5	69.6
1916.....	84.4	75.7	70.4	74.3	116.5	67.6	160.7	61.4	100.6	85.5	115.7
1917.....	129.0	104.5	98.7	105.4	150.6	88.2	165.0	74.2	122.1	117.5	119.5
1918.....	148.0	119.1	137.2	109.2	136.5	98.6	182.3	93.3	134.4	131.3	121.8
1919.....	157.6	129.5	135.3	104.3	130.9	115.6	157.0	105.9	139.1	138.6	123.2
1920.....	150.7	137.4	164.8	163.7	149.4	150.1	164.7	141.8	167.5	154.4	147.5
1921.....	88.4	90.6	94.5	96.8	117.5	97.4	115.0	113.0	109.2	97.6	131.4
1922.....	93.8	87.6	100.2	107.3	102.9	97.3	100.3	103.5	92.8	96.7	126.4
1923.....	98.6	92.7	111.3	97.3	109.3	108.7	101.1	108.9	99.7	100.6	103.9
1924.....	100.0	91.0	106.7	92.0	106.3	102.3	98.9	104.9	93.6	98.1	90.6
1925.....	109.8	100.2	108.3	96.5	103.2	101.7	101.8	103.1	109.0	103.5	95.8
1926.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1927.....	99.4	96.5	95.7	86.5	98.2	93.3	96.6	98.2	89.9	95.4	94.3
1928.....	105.9	101.0	96.3	82.8	99.8	93.7	95.5	97.4	83.0	97.7	87.7
1929.....	104.9	99.7	93.7	81.6	104.4	97.1	94.4	96.9	80.5	96.5	82.9

TREND OF GASOLINE PRICES IN FIFTY UNITED STATES CITIES

A compilation of average gasoline prices quoted by the major marketing companies in 50 representative cities of this country on the first day of each month over the period from January 1, 1919, to July 1, 1930, is given on page 97.

The average tank wagon or wholesale price, exclusive of tax, on July 1, 1930, was 14.63 cents; and the service station price, exclusive of tax, on the same date was 16.37 cents. These are the lowest prices at which gasoline was sold on any July 1 over the period covered, and are well under the combined average prices for the 11 years, 1919-1929, inclusive.

The compilation shows that motorists are paying on an average of 3.78 cents a gallon in state gasoline taxes which, added to the service station price, made the average retail price to the consumer on July 1, 1930, 20.15 cents. The average gasoline tax in 1921 amounted to only a fraction of a cent, and steadily increased each succeeding year. Despite the increase in tax, motorists were paying less for their gasoline on July 1, 1930 than at any corresponding date during the period covered.

INDEX NUMBERS OF WHOLESALE PRICES OF SPECIFIED PRODUCTS, 1926 = 100

Year	Gasoline	Eggs	Sugar	Butter	Milk	Bread	Shoes
1913	84.7	70.0	77.9	72.7	56.9	60.6	48.6
1914	72.5	74.7	85.9	67.5	53.4	63.0	49.6
1915	69.6	72.3	101.5	67.4	53.9	67.9	50.8
1916	115.7	82.4	125.5	76.9	58.2	68.1	58.0
1917	119.5	112.9	140.7	96.3	81.4	99.0	74.2
1918	121.8	137.0	142.2	116.4	99.5	104.1	87.9
1919	123.2	148.7	163.1	136.6	108.4	106.3	118.8
1920	147.5	160.1	231.2	138.5	108.9	124.6	139.9
1921	131.4	113.7	112.4	97.8	96.0	110.9	109.4
1922	126.4	97.6	108.4	91.5	94.5	102.4	101.6
1923	103.9	97.5	154.0	105.6	98.7	98.4	100.4
1924	90.6	102.5	135.8	96.4	88.4	99.9	97.7
1925	95.8	112.0	99.8	102.3	99.2	100.0	99.9
1926	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1927	94.3	89.9	106.2	106.6	103.0	100.0	100.5
1928	87.7	92.6	101.3	106.9	105.6	100.0	105.5
1929	82.9	103.5	92.2	101.3	110.3	94.6	106.3

Gasoline Prices, 1919–1930

AVERAGE 50 REPRESENTATIVE CITIES IN UNITED STATES

Month	1919				1922				1925				1928			
	Tank wagon (ex. tax)	Service station (ex. tax)	State gasoline tax	Service station (inc. tax)	Tank wagon (ex. tax)	Service station (ex. tax)	State gasoline tax	Service station (inc. tax)	Tank wagon (ex. tax)	Service station (ex. tax)	State gasoline tax	Service station (inc. tax)	Tank wagon (ex. tax)	Service station (ex. tax)	State gasoline tax	Service station (inc. tax)
Jan.	$.2424	$.2543	$.....	$.2543	$.2286	$.2493	$.0032	$.2525	$.1399	$.1653	$.0161	$.1814	$.1468	$.1680	$.0307	$.1987
Feb.	.2426	.2545	.....	.2545	.2219	.2425	.0032	.2457	.1687	.1950	.0165	.2115	.1469	.1674	.0307	.1981
Mar.	.2422	.2541	.0002	.2543	.2181	.2391	.0036	.2427	.1910	.2174	.0173	.2347	.1501	.1710	.0303	.2013
Apr.	.2417	.2538	.0006	.2544	.2174	.2398	.0038	.2436	.1878	.2140	.0203	.2343	.1515	.1750	.0304	.2054
May	.2417	.2538	.0008	.2546	.2300	.2519	.0038	.2557	.1835	.2099	.0219	.2318	.1543	.1788	.0304	.2092
Jun.	.2426	.2547	.0008	.2555	.2447	.2668	.0040	.2708	.1903	.2165	.0221	.2386	.1550	.1784	.0304	.2088
Jul.	.2442	.2563	.0008	.2571	.2493	.2713	.0040	.2753	.1932	.2193	.0228	.2421	.1564	.1791	.0304	.2095
Aug.	.2414	.2555	.0008	.2563	.2411	.2630	0040	.2670	.1946	.2207	.0232	.2439	.1608	.1846	.0304	.2150
Sep.	2385	.2532	.0008	.2540	.2290	.2514	.0040	.2554	.1701	.1976	.0233	.2209	.1642	.1878	.0302	.2180
Oct.	.2385	.2532	.0008	.2540	.2288	.2514	.0040	.2554	.1597	.1858	.0233	.2091	.1642	.1878	.0302	.2180
Nov.	.2386	.2530	.0008	.2538	.2074	.2301	.0040	.2341	.1580	.1848	.0233	.2081	.1637	.1874	.0302	.2176
Dec.	.2384	.2531	.0008	.2539	.1992	.2219	.0040	.2259	.1579	.1848	.0233	.2081	.1596	.1832	.0304	.2136
	1920				1923				1926				1929			
Jan.	.2377	.2531	.0008	.2539	.1948	.2177	.0040	.2217	.1629	.1898	.0233	.2131	.1594	.1826	.0308	.2134
Feb.	.2517	.2671	.0008	.2679	.1965	.2192	.0040	.2232	.1626	.1896	.0233	.2129	.1490	.1738	.0312	.2050
Mar.	.2568	.2727	.0008	.2735	.2159	.2392	.0040	.2432	.1731	.1994	.0237	.2231	.1490	.1738	.0316	.2054
Apr.	.2769	.2931	.0008	.2939	.2176	.2409	.0079	.2488	.1768	.2031	.0242	.2273	.1496	.1744	.0336	.2080
May	.2789	.2953	.0008	.2961	.2096	.2333	.0081	.2414	.1838	.2103	.0242	.2345	.1498	.1752	.0350	.2102
Jun.	.2867	.3037	.0008	.3045	.2012	.2250	.0087	.2337	.1978	.2231	.0242	.2473	.1586	.1838	.0350	.2188
Jul.	.2895	.3067	.0010	.3077	.2003	.2236	.0107	.2343	.1982	.2235	.0242	.2477	.1606	.1852	.0360	.2212
Aug.	.2909	.3081	.0010	.3091	.1933	.2179	.0119	.2298	.1982	.2232	.0244	.2476	.1594	.1834	.0370	.2204
Sep.	.2983	.3155	.0010	.3165	.1664	.1916	.0119	.2035	.1978	.2229	.0244	.2473	.1584	.1832	.0374	.2206
Oct.	.3017	.3189	.0010	.3199	.1581	.1834	.0123	.1957	.1947	.2189	.0244	.2433	.1600	.1812	.0374	.2186
Nov.	.3005	.3190	.0010	.3200	.1466	.1717	.0127	.1844	.1849	.2089	.0244	.2333	.1584	.1788	.0374	.2162
Dec.	.2968	.3151	.0010	.3161	.1386	.1641	.0127	.1768	.1791	.2041	.0244	.2285	.1562	.1754	.0374	.2128
	1921				1924				1927				1930			
Jan.	.2959	.3143	.0010	.3153	.1452	.1709	.0137	.1846	.1779	.2029	.0246	.2275	.1554	.1732	.0376	.2108
Feb.	.2874	.3061	.0010	.3071	.1783	.2035	.0137	.2172	.1787	.2037	.0250	.2287	.1524	.1684	.0376	.2060
Mar.	.2640	.2825	.0014	.2839	.1908	.2160	.0138	.2298	.1736	.1997	.0253	.2250	.1440	.1614	.0380	.1994
Apr.	.2549	.2755	.0016	.2771	.1895	.2155	.0141	.2296	.1626	.1893	.0266	.2159	.1408	.1574	.0380	.1954
May	.2507	.2711	.0016	.2727	.1895	.2158	.0141	.2299	.1539	.1798	.0271	.2069	.1508	.1676	.0380	.2056
Jun.	.2367	.2570	.0016	.2586	.1878	.2145	.0149	.2294	.1508	.1771	.0279	.2050	.1502	.1678	.0380	.2058
Jul.	.2193	.2397	.0022	.2419	.1795	.2071	.0153	.2224	.1521	.1779	.0290	.2069	.1463	.1637	.0378	.2015
Aug.	.2133	.2345	.0022	.2367	.1685	.1954	.0155	.2109	.1527	.1785	.0298	.2083				
Sep.	.2095	.2305	.0028	.2333	.1638	.1908	.0155	.2063	.1507	.1751	.0300	.2051				
Oct.	.2065	.2273	.0028	.2301	.1523	.1780	.0155	.1935	.1489	.1718	.0303	.2021				
Nov.	.2191	.2399	.0028	.2427	.1384	.1638	.0155	.1793	.1485	.1699	.0305	.2004				
Dec.	.2340	.2545	.0028	.2573	.1394	.1648	.0155	.1803	.1468	.1684	.0305	.1989				

STATE TAXATION OF GASOLINE

In the last 10 years motorists have paid more than a billion and a half dollars in state gasoline taxes—over one billion dollars in the last three years. In addition, motorists pay out $350,000,000 annually in state motor license fees.

According to the Bureau of Public Roads (U. S. Department of Agriculture), total gasoline taxes in 1929 (including other receipts under the various state gasoline tax laws) amounted to $431,636,000.

During 1929 all states and the District of Columbia were taxing gasoline sales.

This form of taxation began in 1919, Oregon levying a tax of one cent per gallon. In recent years, not only has this form of taxation spread throughout the country, but the rate of the tax has shown a progressive tendency to increase. Today (July 1, 1930) no state is levying as small a rate as one cent per gallon. Seven states and the District of Columbia impose a tax of 2 cents per gallon; ten states, 3 cents per gallon; one state, 3½ cents per gallon; eighteen states, 4 cents per gallon; nine states, 5 cents per gallon; and three states, 6 cents per gallon.

State Gasoline Taxes

1921	$4,700,000
1922	12,100,000
1923	36,800,000
1924	79,700,000
1925	146,100,000
1926	187,600,000
1927	251,800,000
1928	305,234,000
1929	431,636,000

TOTAL TAX EARNED ON MOTOR VEHICLE FUEL, ETC., REFUNDS, DISPOSITION OF FUND, AND GALLONS TAXED

(From Reports of State Authorities)

States	Gross tax assessed prior to deduction of refund	Exemption refund: (deducted from gross tax)	Total tax earning on fuel for motor vehicles[1]	Other receipts, under tax law (licenses)	Grand total earning (tax and other receipts)	Collection cost[2]	Construction and maintenance on rural roads		State and county road bond payment[3]	For miscellaneous purposes	States
							State highway	Local roads			
Alabama	$7,105,009	.....	$7,105,009	.....	$7,105,009	$37,853	$2,367,023	$3,522,447	$1,177,686	.....	Alabama
Arizona	2,886,603	$326,772	2,559,831	$800	2,559,839	[5]	1,599,894	959,945	.....	.....	Arizona
Arkansas	6,681,029	[6]	6,681,029	.....	6,681,029	33,405	4,195,686	420,995	[7]2,031,033	.....	Arkansas
California	37,600,108	3,408,021	34,192,087	.....	34,192,087	8,566	23,181,265	10,960,668	.....	[8]$41,588	California
Colorado	5,745,061	527,582	5,217,479	585	5,218,064	[9]46,915	3,619,804	1,435,478	.....	[10]115,867	Colorado
Connecticut	4,047,092	.....	4,047,092	50,083	4,097,175	.....	4,097,175	.....	.....	.....	Connecticut
Delaware	980,559	44,612	935,947	.....	935,947	.....	935,947	.....	.....	.....	Delaware
Florida	12,203,056	.....	12,203,056	28,280	12,231,336	16,477	5,666,821	1,544,146	.....	[11]5,003,892	Florida
Georgia	10,224,108	.....	10,224,108	.....	10,224,108	4,200	6,567,409	2,195,045	.....	[12]1,457,454	Georgia
Idaho	2,204,977	258,997	1,945,980	379	1,946,359	13,813	1,932,546	.....	.....	.....	Idaho
Illinois[13]	11,659,778	.....	11,659,778	.....	11,659,778	[14]25,000	[15]7,756,519	[15]3,878,259	.....	.....	Illinois[13]
Indiana	16,429,211	818,960	15,610,251	289	15,610,540	33,102	11,683,078	2,920,770	.....	[16]973,590	Indiana
Iowa	10,068,831	713,046	9,355,785	.....	9,355,785	31,728	4,611,780	4,712,277	.....	.....	Iowa
Kansas	9,733,375	1,562,170	8,171,205	.....	8,171,205	[17]	6,371,205	1,800,000	.....	.....	Kansas
Kentucky	7,742,564	.....	7,742,564	.....	7,742,564	25,777	7,716,787	.....	.....	.....	Kentucky
Louisiana	6,979,699	1,048	6,978,651	.....	6,978,651	[18]	5,255,782	.....	1,722,869	.....	Louisiana
Maine	3,841,476	132,794	3,708,682	.....	3,708,682	26,052	2,301,644	1,380,986	.....	.....	Maine
Maryland	6,532,418	235,250	6,297,168	.....	6,297,168	2,500	5,035,734	.....	.....	[19]1,258,934	Maryland
Massachusetts	9,888,730	129,914	9,758,816	.....	9,758,816	20,000	6,770,807	2,968,009	.....	.....	Massachusetts
Michigan	23,558,077	2,249,068	21,309,009	3,920	21,312,929	40,286	11,058,317	6,810,406	3,000,000	[20]403,920	Michigan
Minnesota	9,631,151	739,026	8,892,125	.....	8,892,125	.....	6,283,903	2,608,222	.....	.....	Minnesota
Mississippi	7,045,120	.....	7,045,120	131,006	7,176,126	5,900	2,736,601	4,223,532	.....	[21]210,093	Mississippi
Missouri	7,866,605	185,933	7,680,672	.....	7,680,672	54,940	7,625,732	.....	.....	.....	Missouri
Montana	3,767,737	965,720	2,802,017	.....	2,802,017	13,584	2,788,433	.....	.....	.....	Montana
Nebraska	7,860,046	60,567	7,799,479	.....	7,799,479	7,500	5,982,429	1,809,550	.....	.....	Nebraska
Nevada	712,507	60,206	652,301	.....	652,301	.....	599,377	52,924	.....	.....	Nevada
New Hampshire	2,332,906	65,854	2,267,052	.....	2,267,052	.....	1,700,289	.....	566,763	.....	New Hampshire
New Jersey	9,961,276	[23]	9,961,276	34,828	9,996,104	20,040	9,886,064	.....	.....	[24]90,000	New Jersey
New Mexico	2,273,966	.....	2,273,966	15,801	2,289,767	45,795	1,752,722	.....	491,250	.....	New Mexico
New York[25]	19,488,422	433,248	19,055,174	32,218	19,087,392	[26]	14,278,044	3,807,478	.....	[27]1,001,870	New York[25]
North Carolina	12,506,185	499,801	12,006,384	.....	12,006,384	9,000	7,702,647	.....	4,294,737	.....	North Carolina
North Dakota	2,968,370	1,169,144	1,799,226	1,876	1,801,102	25,000	1,396,102	380,000	.....	.....	North Dakota

GASOLINE TAXES, 1929—(*Continued*)

TOTAL TAX EARNED ON MOTOR VEHICLE FUEL, ETC., REFUNDS, DISPOSITION OF FUND, AND GALLONS TAXED

(From Reports of State Authorities)

States	Gross tax assessed prior to deduction of refund	Exemption refund: (deducted from gross tax)	Total tax earning on fuel for motor vehicles[1]	Other receipts under tax law (licenses)	Grand total earning (tax and other receipts)	Collection cost[2]	Construction and maintenance on rural roads		State and county road bond payment[3]	For miscellaneous purposes	States
							State highway	Local roads			
Ohio	35,741,107	1,658,919	34,082,188	.....	34,082,188	.....	21,316,968	6,567,787	.....	[28]6,197,433	Ohio
Oklahoma	10,870,642	29,033	10,841,609	.....	10,841,609	.....	7,798,066	3,043,543	.....	.....	Oklahoma
Oregon	4,888,886	346,284	4,542,602	.....	4,542,602	8,851	4,533,751	.....	.....	.....	Oregon
Pennsylvania	35,887,503	140,189	35,747,314	10,502	35,757,816	145,825	27,061,099	5,217,705	3,333,187	.....	Pennsylvania
Rhode Island	1,556,538	13,779	1,542,759	3,202	1,545,961	.....	1,160,271	.....	385,690	.....	Rhode Island
South Carolina	6,895,951	29,343	6,866,608	4,468	6,871,076	.....	5,725,897	1,145,179	.....	.....	South Carolina
South Dakota	4,680,153	1,134,388	3,545,765	.....	3,545,765	10,500	2,585,894	.....	845,416	[8]103,955	South Dakota
Tennessee	9,290,853	.....	9,290,853	.....	9,290,853	46,454	4,936,989	1,719,329	[31]2,588,081	.....	Tennessee
Texas	23,092,702	775,208	22,317,494	.....	22,317,494	.....	16,738,121	.....	.....	[32]5,579,373	Texas
Utah	1,979,226	.....	1,979,226	384	1,979,610	4,150	1,536,960	.....	438,500	.....	Utah
Vermont	1,703,091	.....	1,703,091	.....	1,703,091	.....	1,703,091	.....	.....	.....	Vermont
Virginia	10,419,421	524,480	9,894,941	.....	9,894,941	[33]	6,596,627	3,298,314	.....	.....	Virginia
Washington	6,461,106	518,067	5,943,039	.....	5,943,039	[34]	4,663,362	1,279,677	.....	.....	Washington
West Virginia	5,061,572	195,380	4,866,192	7,106	4,873,298	.....	2,376,725	.....	2,496,573	.....	West Virginia
Wisconsin	7,867,899	382,860	7,485,039	.....	7,485,039	10,899	2,752,212	4,183,051	.....	[16]538,877	Wisconsin
Wyoming	1,296,299	.....	1,296,299	.....	1,296,299	4,066	1,024,157	268,076	.....	.....	Wyoming
District of Columbia	1,437,754	9,573	1,428,181	.....	1,428,181	.....	.....	.....	.....	[35]1,428,181	District of Columbia
Total	.....	.....	$431,311,519	$324,935	$431,636,454	$778,178	$297,967,756	$85,113,708	$23,371,785	$24,405,027	Total

[1] This is the net gasoline tax earned after deduction of refunds for exemptions according to law.
[2] Many states pay collection costs from other state funds, and when the amounts are reported same are noted.
[3] Payments for state highway bonds except as noted.
[5] Paid from state budget, $14,433.
[6] No refunds reported this year.
[7] Consists of $514,439 for state bonds and $1,516,694 for county bonds.
[8] Reserve for refunds.
[9] Includes all expenses of state inspector of oils.
[10] For town and city streets.
[11] Consists of $2,758,354 for city streets, $2,233,735 for schools and permanent buildings, and $11,803 for refund reserve.
[12] For public schools.
[14] Estimate from 1927 data.
[15] Funds held by courts pending decision.
[16] For city streets.
[17] From state general fund, $15,000.
[18] State appropriation of $7,500.
[19] For Baltimore city streets and grade crossings.
[20] Consists of $400,000 for city streets and $3,920 (from dealers' licenses) to state general fund.
[21] Special additional tax of 2 and 3 cents in Hancock and Harrison Counties for seawall to protect road.
[23] Exemption claimed upon purchase.
[24] For state Department of Commerce and Navigation.
[26] Charged to state general fund, $24,504.
[27] Consists of $50,000 for reserve for refunds, and $951,870 for New York City.
[28] Consists of $75,000 for rotary fund for refunds, and $6,122,433 for municipal streets.
[31] Consists of $652,833 for state bond payments, and $1,935,249 for county bonds.
[32] Free school fund.
[33] State appropriation of $11,088.
[34] Paid from motor vehicle fund, $7,000.
[35] For repair and improvement of Washington streets.

Authority: U. S. Bureau of Public Roads, Department of Agriculture

It is estimated that the gasoline tax now paid by the motorist averages around 25 per cent of the filling station price of gasoline.

DISTRIBUTION OF THE TAX

Gasoline tax measures are passed by legislatures as good road measures, *i. e.,* the revenues to be used for the construction and maintenance of roads. But in many states, certain of these funds are used for other purposes. In 1929 Florida applied $2,234,000 of its gasoline tax revenue to schools and permanent buildings; Georgia, $1,457,000 to public schools; New Jersey, $90,000 for State Department of Commerce and Navigation; and Texas, $5,579,000 to the " free school fund "; while in new gasoline tax legislation there is a tendency in a number of states to divert funds for uses other than construction and maintenance of roads.

COLLECTION OF THE TAX

State gasoline taxes are paid by the motorist, *i. e.,* the tax is added to the retail price of the product. Under the various state gasoline tax laws, the collection of the tax is made by oil distributing companies, which practically have to guarantee the payment of the tax. In certain states an allowance is being made to cover the cost of collection by these companies, but generally the industry has collected the tax without compensation. In other words, the petroleum refining or marketing company selling gasoline to a dealer pays the tax to the state government on such a sale; the dealer in turn collects the tax from the motorist.

Gasoline Tax Rates by States

THE AMOUNT OF GAS TAX AS FIRST LEVIED AND SUBSEQUENT INCREASES, AND THE YEARS IN WHICH SUCH FIRST LEVIES OR INCREASES BECAME EFFECTIVE

(Figures are cents per gallon)

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Alabama	..	..	..	..	2	2	2	2	4	4	4	4
Arizona	..	..	..	1	3	3	3	3	4	4	4	4
Arkansas	..	..	1	1	3	4	4	4	5	5	5	5
California	..	..	..	..	2	2	2	2	3	3	3	3
Colorado	1	1	1	1	2	2	2	2	3	3	4	4
Connecticut	..	..	1	1	1	1	2	2	2	2	2	2
Delaware	..	..	..	..	1	2	2	2	3	3	3	3
Florida	..	..	1	1	3	3	4	4	5	5	6	6
Georgia	..	..	1	1	3	3	3½	3½	4	4	6	6
Idaho	..	..	..	..	2	2	3	3	4	4	4	5
Illinois	..	..	..	..	..	..	..	..	2	2*	3	3
Indiana	..	..	..	..	2	2	3	3	3	3	4	4
Iowa	..	..	..	..	..	..	2	2	3	3	3	3
Kansas	..	..	..	..	..	..	2	2	2	2	3	3
Kentucky	..	1	1	1	1	3	3	5	5	5	5	5
Louisiana	..	..	..	1	1	2	2	2	2	2	4	4
Maine	..	..	..	..	1	1	3	3	4	4	4	4
Maryland	..	..	..	1	1	2	2	2	4	4	4	4
Massachusetts	..	..	..	..	..	..	..	..	..	..	2	2
Michigan	..	..	..	..	..	..	2	2	3	3	3	3
Minnesota	..	..	..	..	..	..	2	2	2	2	3	3
Mississippi	..	..	..	1	1	3	3	4	4	5	5	5
Missouri	..	..	..	..	..	..	2	2	2	2	2	2
Montana	..	..	1	1	2	2	2	2	3	3	5	5
Nebraska	..	..	..	..	..	..	2	2	2	2	4	4
Nevada	..	..	..	..	2	2	4	4	4	4	4	4
New Hampshire	..	..	..	..	1	2	2	2	3	4	4	4
New Jersey	..	..	..	..	..	..	..	..	2	2	2	2
New Mexico	..	..	1	1	1	1	3	3	5	5	5	5
New York	..	..	..	..	..	..	..	..	..	..	2	2
North Carolina	..	..	1	1	3	3	4	4	4	4	5	5
North Dakota	1	1	1	1	1	1	1	2	2	2	3	3
Ohio	..	..	..	..	..	..	2	2	3	3	4	4
Oklahoma	..	..	..	..	1	2½	3	3	3	3	4	4
Oregon	1	1	2	2	3	3	3	3	3	3	3	4
Pennsylvania	..	..	1	1	2	2	2	2	3	3	4	3**
Rhode Island	..	..	..	..	..	..	1	1	2	2	2	2
South Carolina	..	..	..	2	3	3	5	5	5	5	6	6
South Dakota	..	..	..	1	2	2	3	3	4	4	4	4
Tennessee	..	..	..	..	2	2	3	3	3	3	5	5
Texas	..	..	..	..	1	1	1	1	3	2	4	4
Utah	..	..	..	..	2½	2½	3½	3½	3½	3½	3½	3½
Vermont	..	..	..	..	1	1	2	2	3	3	4	4
Virginia	..	..	..	..	3	3	3	4½	4½	5	5	5
Washington	..	..	1	1	1	2	2	2	2	2	3	3
West Virginia	..	..	..	..	2	2	3½	3½	4	4	4	4
Wisconsin	..	..	..	..	..	..	2	2	2	2	2	2
Wyoming	..	..	..	..	1	1	2½	2½	3	3	4	4
District of Columbia	..	..	..	..	..	2	2	2	2	2	2	2

* Declared unconstitutional February 25, 1928.
** Reverted to three cents July 1, 1930.

Note—The above table is corrected as of July 1, 1930.

Authorities: U. S. Bureau of Public Roads and American Petroleum Institute.

Total Special Motor Vehicle Taxes

State—Registration fees	$347,843,543	
Gasoline tax	431,636,454	
	$779,479,997	$779,479,997
Municipal		20,000,000
Total special taxes		$799,479,997
Personal property tax		130,000,000
Grand total		$929,479,997

Ten Year Total Motor Vehicle Taxes

1920	$316,720,000
1921	341,300,000
1922	334,901,000
1923	471,548,000
1924	551,400,000
1925	667,000,000
1926	712,000,000
1927	760,000,000
1928	798,000,000
1929	929,000,000
Total	$5,881,869,000

Authority: National Automobile Chamber of Commerce.

State Motor License Fees, 1929

State	Total gross receipts	Collection and administration[1]	State highways	Local roads	State and county road bonds[4]	For other purposes
Alabama	$3,736,380	$177,819	$1,324,322	$728,594	$1,505,645	.....
Arizona	748,565	.....	748,565	.....	.....	.....
Arkansas	4,212,161	84,243	914,039	543,369	[5]2,670,510	.....
California	10,489,068	2,098,197	4,195,436	4,195,435	.....	.....
Colorado	1,835,386	166,652	834,367	834,367	.....	.....
Connecticut	7,992,755	618,158	7,374,597	.....	.....	.....
Delaware	1,023,440	.....	1,023,440	.....	.....	.....
Florida	4,959,129	297,548	3,496,186	1,165,395	.....	.....
Georgia	4,568,209	164,825	4,403,384	.....	.....	.....
Idaho	1,787,467	29,344	175,813	1,582,310	.....	.....
Illinois	17,087,209	.....	9,623,138	.....	7,428,636	[6]$35,435
Indiana	6,253,424	276,100	5,977,324	.....	.....	.....
Iowa	11,919,350	417,177	10,962,849	392,225	.....	[7]147,099
Kansas	5,697,306	292,602	3,804,704	1,600,000	.....	.....
Kentucky	5,381,302	235,562	4,555,272	590,468	.....	.....
Louisiana	4,523,634	50,000	4,473,634	.....	.....	.....
Maine	3,030,128	267,806	1,958,220	.....	664,102	140,000
Maryland	3,295,314	329,531	2,372,626	.....	.....	[9]593,157
Massachusetts	7,117,725	1,392,066	4,995,116	.....	730,543	.....
Michigan	23,212,316	891,104	15,239,152	6,000,000	1,082,060	.....
Minnesota	10,846,826	.....	6,990,359	.....	[10]3,800,527	[6]55,940
Mississippi	2,963,381	151,380	253,401	2,558,600	.....	.....
Missouri	9,690,727	454,982	6,168,245	.....	3,067,500	.....
Montana	1,549,487	86,914	.....	1,429,260	.....	[11]33,313
Nebraska	4,289,969	105,927	1,239,342	2,891,798	.....	[7]52,902
Nevada	296,881	15,524	107,385	.....	173,972	.....
New Hampshire	2,248,213	175,797	2,057,374	.....	.....	[7]15,042
New Jersey	14,803,016	948,071	8,716,581	4,782,258	.....	[12]356,106
New Mexico	756,763	74,692	449,726	224,862	[13]7,483	.....
New York	38,293,313	1,415,965	27,360,992	5,806,006	.....	[14]3,710,350
North Carolina	7,045,116	300,000	4,239,853	.....	2,505,283	.....
North Dakota	1,989,475	262,915	[15]928,280	798,280	.....	.....
Ohio	12,860,453	390,000	6,430,226	6,040,227	.....	.....
Oklahoma	6,964,360	215,310	2,770,092	3,978,958	.....	.....
Oregon	7,644,226	351,325	2,142,138	1,807,381	3,343,382	.....
Pennsylvania	29,264,695	1,750,000	23,821,267	.....	2,761,783	[8]931,645
Rhode Island	2,403,809	229,644	2,117,414	45,338	.....	[16]11,413
South Carolina	2,674,379	29,907	2,644,472	.....	.....	.....
South Dakota	3,150,657	63,013	1,575,329	1,512,315	.....	.....
Tennessee	4,288,420	107,368	2,090,526	2,090,526	.....	.....
Texas	20,418,696	796,572	11,521,233	8,100,891	.....	.....
Utah	838,300	130,000	372,900	.....	335,400	.....
Vermont	2,339,782	.....	2,339,782	.....	.....	.....
Virginia	6,145,296	260,000	5,885,296	.....	.....	.....
Washington	7,547,382	346,714	4,561,223	2,231,487	.....	[8]407,958
West Virginia	4,565,836	215,621	1,210,460	.....	3,106,667	[7]33,088
Wisconsin	11,780,703	650,000	6,199,689	4,931,014	.....	.....
Wyoming	647,200	.....	647,200	.....	.....	.....
District of Columbia	665,914	86,423	.....	.....	.....	[17]579,491
Grand total	$347,843,543	$17,402,798	$223,292,969	$66,861,364	$33,183,473	$7,102,939

[1] States for which no figures are shown make appropriations for administration. [2] Payments on state highway bonds, except as noted. [3] Includes payments on county bonds of $1,971,291. [4] For state general funds. [5] For state motor vehicle fee refund. [6] For state highway motor patrol. [7] For Baltimore city streets. [8] County bond payments assumed by state. [9] For auto theft fund. [10] Includes $105,106 for new state highway office building and $251,000 for free bridge commission. [11] Interest on notes outstanding. [12] For New York City general fund. [13] Includes special state bridge fund. [14] For administration of fuel tax law. [15] For traffic control signals, and streets, as appropriated by Congress.

Authority: U. S. Bureau of Public Roads

PRODUCTION OF OIL IN THE UNITED STATES

U. S. PRODUCTION AND VALUE OF CRUDE OIL

During the last decade the petroleum industry has been under the necessity of constantly finding new oil sources, if the demands of the motorist and other users were to be supplied. How well it has succeeded is shown by the fact that in 1919 the total oil production of this country was 378,367,000 barrels, while in 1929 production was over 1,000,000,000 barrels.

OVER THREE HUNDRED THOUSAND PRODUCING OIL WELLS

There are over 300,000 producing oil wells in the United States. The latest official figures (December 31, 1928) recorded 327,800 producing oil wells. Some are yielding oil at a high rate—being flowing wells comparatively recently drilled, *i. e.,* wells with " flush " production; while others are wells which are still flowing but their production has greatly declined since completion and is steadily declining to a point where they must be pumped to be commercially productive. Still another class of wells—and this is by far the largest in point of number—are the pumping wells with " settled " production. Usually, after wells are put on the pump, the decline in production is slow, as compared with the rapid decline of flowing wells; and this has caused the production from such wells to be called " settled " production.

The average production per well per day in the United States is 7.6 barrels—based on total production during December 1928, divided by the 327,800 wells producing at the end of that month.

In the older fields, where virtually all the wells are pumping wells, the average production per well is in most cases less than one barrel a day. For instance, in Pennsylvania, where there are 78,600 producing oil wells, nearly a fourth of the country's total, the wells average less than half a

barrel a day. Some of these wells have been producing for many years.

U. S. Production and Value of Crude Oil

Year	Production (thousands of barrels)	Value at wells (thousands of dollars)	Year	Production (thousands of barrels)	Value at wells (thousands of dollars)
1859	2	$ 32	1895	52,892	$57,632
1860	500	4,800	1896	60,960	58,519
1861	2,114	1,036	1897	60,476	40,874
1862	3,057	3,210	1898	55,364	44,193
1863	2,611	8,226	1899	57,071	64,604
1864	2,116	20,897	1900	63,621	75,989
1865	2,498	16,460	1901	69,389	64,417
1866	3,598	13,455	1902	88,767	71,179
1867	3,347	8,067	1903	100,461	94,694
1868	3,646	13,217	1904	117,081	101,175
1869	4,215	23,730	1905	134,717	84,157
1870	5,261	20,504	1906	126,494	92,445
1871	5,205	22,591	1907	166,095	120,107
1872	6,293	21,441	1908	178,527	129,079
1873	9,894	18,100	1909	183,171	128,328
1874	10,927	12,648	1910	209,557	127,900
1875	8,788	7,368	1911	220,449	134,045
1876	9,133	22,983	1912	222,935	164,212
1877	13,350	31,789	1913	248,446	237,121
1878	15,397	18,045	1914	265,763	214,125
1879	19,914	17,211	1915	281,104	179,463
1880	26,286	24,601	1916	300,767	330,900
1881	27,661	23,512	1917	335,316	522,635
1882	30,350	23,631	1918	355,928	703,944
1883	23,450	25,740	1919	378,367	760,266
1884	24,218	20,477	1920	442,929	1,360,745
1885	21,859	19,194	1921	472,183	814,745
1886	28,065	20,028	1922	557,531	895,111
1887	28,283	18,857	1923	732,407	978,430
1888	27,612	17,950	1924	713,940	1,022,683
1889	35,164	26,963	1925	763,743	1,284,960
1890	45,824	35,365	1926	770,874	1,447,760
1891	54,293	30,527	1927	901,129	1,172,830
1892	50,515	25,950	1928	901,474	1,054,880
1893	48,431	28,932	*1929	1,006,000	1,237,380
1894	49,344	35,522			

* Preliminary. Authority: U. S. Bureau of Mines.

There are a large number of old wells in Oklahoma which produce little more, or less, than a barrel a day; but Oklahoma also has many wells in new fields producing at a high daily rate. The average production per well per day in the

state is 11.0 barrels for 62,900 wells. There are 35,750 wells in Texas, averaging 20.8 barrels a day. The average yield of California wells is relatively high, amounting to 57.6 barrels for 10,710 wells.

PRODUCING OIL WELLS IN THE UNITED STATES

State	December 31, 1927		December 31, 1928	
	Number of wells	Average per day per well (barrels)	Number of wells	Average per well per day (barrels)
Arkansas	4,550	24.2	4,520	19.3
California[1]	11,280	55.9	10,710	57.6
Colorado	170	51.7	210	39.9
Illinois	16,240	1.2	16,340	1.1
Indiana:				
Southwestern	1,100	1.9	1,140	2.3
Northeastern	960	0.3	900	.3
Total Indiana	2,060	1.1	2,040	1.4
Kansas	19,600	5.8	19,800	5.4
Kentucky	13,500	1.4	13,740	1.5
Louisiana:				
Gulf Coast	250	56.5	320	67.6
Rest of state	4,000	12.2	3,500	10.8
Total Louisiana	4,250	14.8	3,820	14.8
Michigan	300	6.2	400	4.6
Montana	980	15.3	1,100	10.5
New Mexico	250	14.0	260	10.1
New York	16,740	0.4	16,500	.4
Ohio:				
Central and eastern	20,100	0.8	20,950	.7
Northwestern	17,500	0.3	16,950	.3
Total Ohio	37,600	0.5	37,900	.5
Oklahoma	61,750	12.3	62,900	11.0
Pennsylvania	78,480	0.3	78,600	.3
Texas:				
Gulf Coast	2,600	50.3	2,850	39.6
Rest of state	29,400	16.7	32,900	19.1
Total Texas	32,000	19.5	35,750	20.8
West Virginia	19,900	0.8	19,600	.8
Wyoming	3,560	16.8	3,520	16.6
Other[2]	90	....	90	....
Totals	323,300	7.7	327,800	7.6

[1] From American Petroleum Institute.
[2] Alaska, Tennessee, and Utah.

Authority: U. S. Bureau of Mines.

WELLS DRILLED SINCE BEGINNING OF INDUSTRY

Since the beginning of the petroleum industry in 1859, 789,451 wells have been drilled for oil and gas in this country. Prior to 1900 the total yearly completions, including dry holes, did not exceed 15,000 wells. Deeper drilling has been the outstanding feature of recent years.

NUMBER OF WELLS DRILLED SINCE BEGINNING OF INDUSTRY

UNITED STATES

Year	Total wells completed	Year	Total wells completed	Year	Total wells completed
1859	2	1884	2,269	1909	18,327
1860	49	1885	2,814	1910	14,940
1861	78	1886	3,583	1911	13,768
1862	92	1887	1,981	1912	17,180
1863	137	1888	2,127	1913	25,590
1864	226	1889	6,507	1914	23,137
1865	474	1890	8,347	1915	14,157
1866	442	1891	5,101	1916	24,619
1867	618	1892	3,771	1917	23,407
1868	928	1893	4,170	1918	25,687
1869	1,500	1894	7,551	1919	29,173
1870	1,664	1895	13,069	1920	33,911
1871	1,470	1896	13,808	1921	21,937
1872	1,183	1897	9,538	1922	24,689
1873	1,263	1898	8,644	1923	24,438
1874	1,317	1899	13,984	1924	21,888
1875	2,400	1900	15,517	1925	25,623
1876	2,920	1901	14,372	1926	29,319
1877	3,940	1902	15,407	1927	24,143
1878	3,064	1903	18,365	1928	22,331
1879	3,049	1904	20,261	1929	26,356
1880	4,220	1905	16,731		
1881	3,833	1906	19,057	Total	789,451
1882	3,307	1907	19,872		
1883	2,850	1908	16,909		

Authorities: U. S. Geological Survey, Bureau of Mines, and *Oil and Gas Journal.*

OVER TWENTY THOUSAND WELLS DRILLED ANNUALLY

According to an old saying in the oil industry, " the only proof of oil production is in the drill "; and to supply the demand for oil over twenty thousand wells are drilled each year at a cost running over half a billion dollars annually. During 1929 a total of 26,356 wells were completed, of which 15,572, or 60 per cent, found oil; 2,870, or 10 per cent, found gas; and 7,914, or 30 per cent, were dry.

WELLS DRILLED IN THE UNITED STATES

1908-1929

Year	Wells completed			
	Oil	Gas	Dry	Total
1908	13,210	485	3,214	16,909
1909	13,875	1,048	3,404	18,327
1910	11,018	1,500	2,422	14,940
1911	9,825	1,580	2,363	13,768
1912	12,514	1,811	2,855	17,180
1913	19,101	2,207	4,282	25,590
1914	16,668	2,327	4,142	23,137
1915	9,154	2,022	2,981	14,157
1916	18,777	1,803	4,039	24,619
1917	16,590	1,966	4,851	23,407
1918	17,845	2,229	5,613	25,687
1919	21,052	2,135	5,986	29,173
1920	24,273	2,274	7,364	33,911
1921	14,666	2,111	5,160	21,937
1922	17,333	2,024	5,332	24,689
1923	16,206	2,349	5,883	24,438
1924	14,587	2,257	5,044	21,888
1925	16,559	2,330	6,734	25,623
1926	19,013	2,341	7,965	29,319
1927	14,442	2,491	7,210	24,143
1928	12,526	2,727	7,078	22,331
1929	15,572	2,870	7,914	26,356

Authorities: U. S. Bureau of Mines and *Oil and Gas Journal.*

NEARLY ONE-THIRD OF WELLS DRILLED ARE DRY

Nearly one-third of all the wells drilled for oil and gas are dry. In 1929, 30 per cent of all wells completed were dry. Thousands of wells are drilled to completion annually, and the records show that during the last five years failures have averaged over 29 per cent. In addition, many wells which are listed when they come in as producing fall off rapidly and fail to maintain commercial production.

PERCENTAGE OF DRY HOLES TO TOTAL OIL AND GAS WELLS COMPLETED

Year	Total completions	Dry holes	Per cent dry
1908	16,909	3,214	19.0
1909	18,327	3,404	18.6
1910	14,940	2,422	16.2
1911	13,768	2,363	17.2
1912	17,180	2,855	16.6
1913	25,590	4,282	16.7
1914	23,137	4,142	17.9
1915	14,157	2,981	21.1
1916	24,619	4,039	16.4
1917	23,407	4,851	20.7
1918	25,687	5,613	21.9
1919	29,173	5,986	20.5
1920	33,911	7,364	21.7
1921	21,937	5,160	23.5
1922	24,689	5,332	21.6
1923	24,438	5,883	24.1
1924	21,888	5,044	23.0
1925	25,623	6,734	26.3
1926	29,319	7,965	27.2
1927	24,143	7,210	29.9
1928	22,331	7,078	31.7
1929	26,356	7,914	30.0

Authority: U. S. Bureau of Mines.

INITIAL PRODUCTION OF OIL WELLS

When a well is drilled into an oil sand, it usually produces its largest amount immediately upon completion; in other words, the initial production of oil wells represents the maximum output. The flow of oil usually subsides, either gradually or rapidly as the case may be, after the early production stages. During the last eight or nine years the daily average initial production of wells drilled in the United States has been higher than formerly. In 1928 the initial daily average production per well was 668 barrels, the largest ever recorded—indicating that new wells completed during the year came in exceptionally large producers. In 1929 the average initial production was much lower—396 barrels.

Daily Average Initial Production of Oil Wells Completed

Year	Oil wells completed	Daily average initial production (barrels)	Initial production per well (barrels)
1916	18,777	1,601,170	85
1917	16,590	1,511,028	91
1918	17,845	1,613,813	90
1919	21,052	3,554,486	168
1920	24,273	3,508,100	145
1921	14,666	2,827,809	193
1922	17,333	4,226,119	244
1923	16,206	6,105,100	377
1924	14,587	3,255,491	223
1925	16,559	4,300,356	260
1926	19,013	3,683,787	194
1927	14,442	4,918,456	340
1928	12,526	8,365,778	668
1929	15,572	6,170,311	396

Authority: U. S. Bureau of Mines.

GOVERNMENT AND INDIAN OIL LANDS

The federal government is the owner of areas embracing several hundred million acres of land, the title to which is really held in trust for the public generally. Within these

areas are proved oil fields and also much tested territory, holding in varying degrees promise of oil in commercial quantities.

Oil lands on the Public Domain are leased in accordance with the provisions of the leasing act of February 25, 1920.

However, President Hoover, on March 12, 1929, announced that "there will be no leases or disposal of government oil lands, no matter what category they may lie in, of government holdings or government controls, except those which may be mandatory by Congress. In other words, there will be complete conservation of government oil by this administration." * The President's action is being tested in the courts.

Statistics relating to the production of petroleum, natural gas, and natural gasoline under government lease, permit, and license involving public land are summarized in the following tables:

PETROLEUM, NATURAL GAS, AND NATURAL GASOLINE PRODUCED FROM PUBLIC LANDS

Fiscal year	Petroleum	Natural gas	Gasoline
	Barrels	*M cubic feet*	*Gallons*
1921–1925	118,333,954.01	60,298,796.00	63,997,718.97
1926	29,712,876.16	18,535,880.50	35,910,791.54
1927	25,648,101.43	17,723,410.03	40,104,404.57
1928	23,370,549.38	18,922,026.00	39,698,292.82
1929	22,458,842.62	22,770,394.11	47,319,874.32
	219,524,323.60	138,250,506.64	227,031,082.22

1929, by States

California	5,790,220.07	1,208,043.11	8,199,733.80
Colorado	962,170.29	64,360.00	73,522.00
Louisiana	7,823.92	759,719.00	54,248.60
Montana	617,051.45	1,082,999.00	.....
New Mexico	158,202.44	253,924.00	3,792.00
Oklahoma	465,086.76	.....	1,528,001.92
Utah	2,953.13	1,004,659.00	.....
Wyoming	14,455,334.56	18,396,690.00	37,460,576.00

Authority: U. S. Geological Survey.

* See Appendix: Conservation of Petroleum; "Petroleum Facts and Figures," second edition, and this edition.

ROYALTY AND BONUSES ACCRUED FROM OIL AND GAS OPERATIONS ON PUBLIC LANDS

Fiscal year	Royalty			Bonuses	Total
	Petroleum	Natural gas	Gasoline		
1921–1925	$32,938,494.47	$398,543.30	$251,197.70	$2,768,085.14	$36,356,320.61
1926	7,951,665.52	93,508.29	154,265.43	250,503.94	8,449,943.18
1927	5,741,485.97	91,796.54	173,172.59	3,980.00	6,010,435.10
1928	3,519,810.55	108,570.86	107,070.00	672,500.00	4,407,951.41
1929	3,437,477.58	125,013.01	116,254.69	7,138.07	3,685,883.35
	$53,588,934.09	$817,432.00	$801,960.41	$3,702,207.15	$58,910,533.65
1929, by States					
California	$642,073.06	$6,030.46	$17,641.31	.....	$665,744.83
Colorado	45,702.15	1,484.14	96.27	.....	47,282.56
Louisiana	1,606.07	2,022.43	246.49	$6,848.07	10,723.06
Montana	73,677.27	3,911.40	.....	.....	77,588.67
New Mexico	30,022.84	6,943.49	125.54	.....	37,091.87
Oklahoma	107,752.03	.....	6,408.24	.....	114,160.27
Utah	305.84	6,071.62	.....	.....	6,377.46
Wyoming	2,536,338.32	98,549.47	91,736.04	290.00	2,726,914.63

Authority: U. S. Geological Survey.

In addition to production from public lands, there is the production of petroleum, natural gas, and natural gasoline from Naval Petroleum Reserves No. 1 and 2, in California. Production from Naval Petroleum Reserve No. 3, in Wyoming, was suspended in January 1928.

PETROLEUM, NATURAL GAS, AND GASOLINE PRODUCED FROM NAVAL RESERVES

By States

	Petroleum	Natural gas	Gasoline
California:	*Barrels*	*M cubic feet*	*Gallons*
1921-1925	37,882,945.09	35,544,349.81	34,508,751.07
1926	12,234,702.16	12,917,255.09	19,851,282.68
1927	12,368,315.70	12,328,208.69	24,052,402.12
1928	9,690,573.93	9,077,966.68	24,797,263.61
1929	8,116,635.98	7,711,858.00	24,908,262.82
	80,293,172.86	77,579,638.27	128,117,962.30
Wyoming:			
1923-1925	2,523,213.05	950,520.00	7,829.00
1926	520,680.00	1,458,032.00	291,852.00
1927	357,049.32	1,958,463.00	1,441,036.00
1928	149,285.26	795,854.00	743,179.00
	3,550,227.63	5,162,869.00	2,483,896.00
Total			
1921-1925	40,406,158.14	36,494,869.81	34,516,580.07
1926	12,755,382.16	14,375,287.09	20,143,134.68
1927	12,725,365.02	14,286,671.69	25,493,438.12
1928	9,839,859.19	9,873,820.68	25,540,442.61
1929	8,116,635.98	7,711,858.00	24,908,262.82
	83,843,400.49	82,742,507.27	130,601,858.30

Authority: U. S. Geological Survey.

ROYALTY ACCRUED FROM NAVAL PETROLEUM RESERVES

By States

State	Petroleum	Natural gas	Gasoline	Total
California:				
1921–1925	$10,127,293.96	$287,996.12	$231,447.70	$10,646,737.78
1926	3,187,461.22	100,089.27	151,296.95	3,438,847.44
1927	3,094,331.59	90,475.99	163,760.36	3,348,567.94
1928	1,909,711.11	125,866.88	162,834.08	2,198,412.07
1929	1,583,072.32	82,685.76	151,706.37	1,817,464.45
	$19,901,870.20	$687,114.02	$861,045.43	$21,450,029.68
Wyoming:				
1923–1927	$763,114.40	$44,765.64	$7,104.55	$814,984.59
1928	24,169.70	7,952.86	1,840.76	33,963.32
1929	.....	.....	.....	.....
	$787,284.10	$52,718.50	$8,945.31	$848,947.91
Total				
1921–1925	$10,685,660.38	$298,874.65	$231,485.45	$11,216,020.48
1926	3,310,658.54	114,247.75	152,480.36	3,577,386.65
1927	3,175,882.25	110,204.62	169,643.75	3,455,730.62
1928	1,933,880.81	133,819.74	164,674.84	2,232,375.39
1929	1,583,072.32	82,685.76	151,706.37	1,817,464.45
	$20,689,154.30	$739,832.52	$869,990.77	$22,298,977.59

Authority: U. S. Geological Survey.

OIL ON INDIAN RESERVATIONS

Oil has been discovered on a number of Indian reservations, notably in Oklahoma. One of the richest oil areas in the United States is found in the Osage Nation in Oklahoma, and belongs to the Osage Tribe of Indians. These lands were purchased in June 1883 by the Osages from the Cherokee Indians, at a price of $1.25 per acre. The Cherokees, at the time of the sale, thought they had made a fine bargain. The Osages were allotted the surface of the lands individually, but the mineral rights were reserved for the benefit of the tribe collectively. Hence the members share equally in oil royalties and bonuses. Each enrolled Osage Indian, in the fiscal year 1929, received from the government approximately $4,050.

The Indians of the five civilized tribes—Cherokee, Choctaw, Chickasaw, Creek, and Seminole Indians—did not reserve to the tribe the mineral rights when allotments were made. Therefore, some Indians have received lands on

which tremendous sums in royalties from oil production have been paid, while others received only agricultural lands. Some of the Creek Indians in Oklahoma have received as high as $50,000 a year from oil royalties.

Oil has also been discovered or developed in the Pawnee, Otoe, and Kiowa Reservations in Oklahoma; the Crow Reservation, in Montana; the Shoshone Reservation, in Wyoming, and the Ute Reservation in Colorado. Sales of leases and development of oil have also occurred on the Navajo Indian Reservation in New Mexico.

PER CAPITA BONUS PAYMENTS TO THE OSAGES

Year ending June 30	Number of payments	Amount of each share	Total amount
1916	4	$384.93	$858,008.97
1917	6	2,719.98	6,062,835.42
1918	6	3,672.33	8,185,623.57
1919	7	3,930.00	8,759,970.00
1920	9	8,090.00	18,032,610.00
1921	7	8,600.00	19,169,400.00
1922	4	7,700.00	17,163,300.00
1923	4	12,400.00	27,639,600.00
1924	4	11,600.00	25,856,400.00
1925	3	9,300.00	20,729,700.00
1926	5	13,400.00	29,868,600.00
1927	4	7,700.00	17,163,300.00
1928	4	5,900.00	12,705,300.00
1929	4	4,050.00	9,027,050.00

NOTE.—The above tabulation does not include interest in trust funds in the U. S. Treasury, which is also paid out quarterly, and amounts to $47.75 to each enrolled Osage who has not withdrawn any part of such trust funds. And it does not include miscellaneous receipts.

Authority: Office of Indian Affairs, Department of Interior.

OSAGE OIL DEVELOPMENT

Auctions of Osage Indian Reservation oil and gas leases have been held periodically since 1912. Under the prescribed method of development, oil companies and individuals bid against each other in the payment of bonuses for the leases;

that is, for the privilege of drilling wells. The individual tracts offered are of 160 acres each, and bonuses as high as $1,900,000 have been paid for one tract. In addition to these bonuses, the members of the Osage Tribe receive royalties of one-fifth or one-sixth of the oil produced.

OSAGE OIL LEASE SALES AND BONUSES

Date of sale	Acres offered	Acres sold	Bonus offered	Average
Nov. 11, 1912	107,594	24,541	$39,436.00	$1.60
Sept. 29, 1913	12,049	10,132	498,182.58	49.17
Apr. 20, 1916	17,280	14,377	2,057,600.00	143.11
June 20, 1916	3,020	2,482	1,169,280.78	471.10
May 31, 1917	9,120	8,160	1,947,600.00	238.67
Nov. 12, 1917	20,621	19,869	1,677,200.00	84.42
Feb. 14, 1918	32,160	25,440	1,275,500.00	50.14
May 18, 1918	51,400	38,890	1,180,575.00	30.29
Nov. 9, 1918	43,040	34,720	3,350,200.00	96.49
Mar. 5, 1919	21,000	20,520	2,790,925.00	136.01
June 6, 1919	39,251	38,451	3,884,925.00	101.04
Oct. 6, 1919	35,310	34,670	6,056,950.00	174.70
Feb. 3, 1920	31,613	29,533	3,102,700.00	105.05
May 18, 1920	31,783	31,303	2,851,900.00	91.10
Oct. 12, 1920	36,877	36,877	3,993,750.00	108.30
June 14, 1921	26,588.7	25,918.7	4,559,100.00	175.90
Dec. 12, 1921	36,414.4	35,665.1	7,261,600.00	203.60
Mar. 2, 1922	37,184.2	33,467.5	3,949,950.00	118.02
June 28, 1922	34,660.15	33,220.15	10,889,700.00	327.80
Jan. 18, 1923	33,913.88	24,071.24	6,217,500.00	256.29
Apr. 5, 1923	33,790.34	23,640	8,029,100.00	339.64
Mar. 18–19, 1924	100,305.38	50,982.24	14,193,300.00	278.40
June 30, 1924	19,785.41	11,145.41	2,250,200.00	201.89
Dec. 18, 1924	29,889.73	8,609.73	1,087,300.00	126.00
Mar. 18, 1925	35,227.98	12,205.07	671,650.00	55.03
Mar. 17–18, 1926	113,392.04	46,331.45	3,998,485.00	86.30
Sept. 30, 1926	35,780.72	15,520	2,117,300.00	136.42
Mar. 28, 1927	74,564.31	20,656.16	2,435,700.00	117.92
Dec. 12, 1927	20,000	18,720	2,267,550.00	121.12
Mar. 28–29, 1928	92,229.67	63,440.90	2,437,300.00	38.42
Sept. 27, 1928	19,992.15	19,992.15	986,200.00	49.32
Dec. 11, 1928	30,079.65	27,442.30	437,410.00	15.93
Total	1,285,917.71	841,085.11	$109,666,069.36	

Authority: Office of Indian Affairs, Department of Interior.

OSAGE OIL AND GAS PRODUCTION AND ROYALTIES

Year ended June 30	Gross oil production barrels	Oil, gas, and gasoline royalties
1901	10,536	$603.25
1902	10,522	448.26
1903	52,217	2,957.71
1904	90,806	9,713.74
1905	1,868,260	128,897.12
1906	4,514,004	228,267.34
1907	5,547,167	301,580.48
1908	4,775,289	246,795.86
1909	4,816,462	248,013.53
1910	5,091,424	233,991.45
1911	9,418,769	517,691.21
1912	9,445,669	656,176.47
1913	7,787,030	778,300.22
1914	11,091,791	1,358,392.08
1915	7,257,788	524,252.52
1916	9,805,477	1,097,854.71
1917	9,943,919	3,417,815.95
1918	10,906,376	4,602,799.75
1919	12,138,086	5,420,674.71
1920	17,077,348	9,052,551.78
1921	20,621,614	11,308,746.20
1922	28,941,934	9,235,691.80
1923	41,810,178	14,072,541.61
1924	37,577,900	11,879,496.15
1925	33,662,179	11,144,492.63
1926	25,682,848	10,349,864.76
1927	25,884,734	10,386,837.61
1928	21,741,225	6,032,177.05
1929	16,629,115	4,925,777.78
Total	384,200,667	$118,163,403.73

Authority: Office of Indian Affairs, Department of Interior.

GROSS PRODUCTION OF OIL BY FIELDS

The following tables are compiled from weekly gross production estimates issued by the American Petroleum Institute:

GROSS PRODUCTION OF OIL BY FIELDS

	1928		1929	
	Total barrels	Daily average barrels	Total barrels	Daily average barrels
OKLAHOMA				
North Braman	1,064,200	2,900	1,349,750	3,700
South Braman	576,400	1,550	.....	.....
Blackwell	1,289,650	3,500	1,394,300	3,800
Hubbard	989,050	2,700	679,950	1,850
Thomas	487,350	1,350	306,350	850
Tonkawa	4,939,800	13,500	3,552,600	9,750
Garber	3,129,650	8,550	1,994,800	5,450
Burbank	11,962,950	32,700	7,291,250	20,000
Osage (outside Burbank)	10,236,200	27,950	9,492,900	26,000
Watchhorn	163,100	450	.....	.....
Cushing	7,452,900	20,350	6,738,100	18,450
Yale-Jennings	3,023,750	8,250	2,604,900	7,150
Davenport	729,650	2,000	526,900	1,450
Bristow Slick	8,195,250	22,400	7,202,900	19,750
North Okmulgee	5,527,800	15,100	4,730,400	12,950
Lyons-Deaner	2,209,600	6,050	.....	.....
Stroud	197,050	550	.....	.....
Cromwell	3,460,050	9,450	2,884,850	7,900
Papoose	1,626,300	4,450	1,211,700	3,300
Wewoka	2,436,450	6,650	1,725,700	4,750
Seminole	18,345,950	50,100	11,916,100	32,650
East Seminole	.....	.....	1,117,950	3,050
Bowlegs	23,987,900	65,550	12,125,900	33,250
Searight	5,211,150	14,250	3,884,400	10,650
Little River	24,790,650	67,750	28,515,800	78,150
East Earlsboro	.....	.....	399,050	1,100
Earlsboro	33,375,750	91,200	25,366,450	69,500
East Little River	.....	.....	205,850	550
Duncan District	2,650,150	7,250	2,705,200	7,400
Graham	1,995,550	5,450	1,539,800	4,200
Fox	611,650	1,650	511,550	1,400
Healdton	5,121,750	14,000	4,704,450	12,900
Hewitt	3,345,150	9,150	2,955,600	8,100
Scholem Alechem	5,250,250	14,350	4,789,750	13,150
Pearson	597,700	1,650	530,800	1,450
St. Louis	18,289,900	49,950	30,317,550	83,050
Allen Dome	4,527,800	12,350	8,968,400	24,550
Maud	450,800	1,250	7,292,550	20,000
Sasakwa	.....	.....	1,195,300	3,300
Asher	.....	.....	1,383,750	3,800
Oklahoma City	.....	.....	8,636,550	23,650
Logan Co.	.....	.....	5,645,800	15,450
South Okmulgee	.....	.....	2,871,950	7,850
Mission	.....	.....	8,877,600	24,300
Carr City	.....	.....	2,268,650	6,200
Others	24,161,750	66,000	18,855,300	51,650
Total	242,411,000	662,300	251,269,400	688,400

GROSS PRODUCTION OF OIL BY FIELDS—(*Continued*)

	1928		1929	
	Total barrels	Daily average barrels	Total barrels	Daily average barrels
KANSAS				
Greenwood Co.	10,302,050	28,150	7,704,100	21,100
Florence-Covert	434,500	1,200	352,050	950
Peabody-Elbing	1,264,400	3,450	1,127,150	3,100
Eldorado-Towanda	4,945,100	13,500	4,651,950	12,750
Augusta-Fox Bush	1,356,750	3,700	1,087,700	3,000
Rainbow Bend	579,900	1,600	387,800	1,050
Russell	1,261,750	3,450	1,182,200	3,250
Churchill	3,798,250	10,350	2,412,750	6,600
Oxford	4,338,100	11,850	1,703,000	4,650
Sedgwick Co.	.....	.....	8,812,750	24,150
Others	9,947,900	27,200	11,570,000	31,700
Total	38,228,700	104,450	40,991,450	112,300
PANHANDLE TEXAS				
Hutchinson Co.	13,794,950	37,700	9,566,300	26,200
Carson Co.	2,472,350	6,750	2,854,150	7,850
Gray Co.	7,816,700	21,350	18,508,650	50,700
Wheeler Co.	346,700	950	307,100	850
Others	302,550	850	516,150	1,400
Total	24,733,250	67,600	31,752,350	87,000
NORTH TEXAS				
Burkburnett	3,992,500	10,900	3,325,750	9,100
Electra	4,607,600	12,600	4,483,150	12,250
Iowa Park and K. M. A.	1,180,050	3,200	1,897,200	5,200
Wilbarger	8,004,950	21,900	10,507,450	28,800
Archer	7,402,550	20,250	6,571,850	18,000
Montague-Cook	4,254,900	11,600	4,959,500	13,600
Others	226,250	600	251,250	700
Total	29,668,800	81,050	31,996,150	87,650
WEST CENTRAL TEXAS				
Stephens Co.	2,748,900	7,500	2,345,450	6,450
Eastland Desdemona	2,781,950	7,600	2,468,150	6,750
Brown Co.	4,503,500	12,300	3,262,400	8,950
Coleman Co.	978,950	2,650	1,942,850	5,300
Callahan Co.	1,363,450	3,750	1,367,050	3,750
Shackleford Co.	3,433,850	9,400	4,189,050	11,500
Young Co.	3,062,400	8,350	2,740,800	7,500
Throckmorton Co.	343,900	950	240,300	650
Palo Pinto Co.	160,050	450	157,500	450
Jack Co.	539,950	1,450	1,026,700	2,800
Others	232,400	650	299,450	800
Total	20,149,300	55,050	20,039,700	54,900

GROSS PRODUCTION OF OIL BY FIELDS—(*Continued*)

	1928		1929	
	Total barrels	Daily average barrels	Total barrels	Daily average barrels
WEST TEXAS				
Jones Co.	886,650	2,400	1,555,950	4,250
Mitchell and Scurry Co...	1,106,550	3,050	959,050	2,650
Howard Co.	4,802,800	13,100	15,090,250	41,350
Reagan Co.	6,855,700	18,750	6,577,900	18,000
Crane and Upton Co.	25,741,650	70,350	17,277,750	47,350
Crockett Co.	994,100	2,700	791,950	2,150
Pecos Co.	22,108,700	60,400	41,336,950	113,250
Winkler Co.	57,204,350	156,300	50,302,600	137,800
Others	652,700	1,800	797,300	2,200
Total	120,353,200	328,850	134,689,700	369,000
EAST CENTRAL TEXAS				
Mexia	2,565,800	7,000	1,998,650	5,450
Currie	189,650	500	159,100	450
Richland	196,650	550	138,850	400
Wortham	652,750	1,800	401,350	1,100
Corsicanna-Powell	4,011,250	10,950	2,848,300	7,800
Nigger Creek	411,950	1,150	164,000	450
Boggy Creek	.....	.....	1,132,100	3,100
Van Zandt Co.	.....	.....	139,550	400
Others	297,950	800	.....	.....
Total	8,326,000	22,750	6,981,900	19,150
SOUTHWEST TEXAS				
Luling	4,910,050	13,400	4,272,850	11,700
Lytton Springs	456,550	1,250	354,300	950
Somerset	266,000	700	471,300	1,300
Laredo District	2,795,500	7,650	3,936,100	10,800
Dale	365,100	1,000	183,700	500
Refugio Co.	.....	.....	1,336,700	3,650
Salt Flat	215,300	600	13,586,500	37,250
Others	251,100	700	1,422,250	3,900
Total	9,259,600	25,300	25,563,700	70,050

GROSS PRODUCTION OF OIL BY FIELDS—(*Continued*)

	1928		1929	
	Total barrels	Daily average barrels	Total barrels	Daily average barrels
NORTH LOUISIANA				
Homer	1,578,900	4,300	1,433,550	3,950
Haynesville	2,223,800	6,100	1,875,350	5,150
Caddo Light	3,661,400	10,000	3,518,100	9,650
Caddo Heavy	1,246,200	3,400	1,138,300	3,100
De Soto-Red River	1,500,150	4,100	1,315,850	3,600
Elm Grove	208,050	550	207,650	550
Bellevue	339,900	950	238,350	650
Cotton Valley (light)	745,250	2,050	983,900	2,700
Cotton Valley (heavy)	1,063,750	2,900		
Urania	2,576,450	7,000	2,138,600	5,850
Pleasant Hill	219,050	600	257,600	700
Zwolle	.....	.....	127,450	350
Others	.....	.....	118,950	350
Total	15,362,900	41,950	13,353,650	36,600
ARKANSAS				
Eldorado	1,913,550	5,250	1,666,900	4,550
Smackover (light)	2,834,500	7,750	2,240,300	6,150
Smackover (heavy)	21,905,850	59,850	17,381,450	47,600
Stephens	384,200	1,050	367,100	1,000
Nevada	576,650	1,600	412,600	1,150
Lisbon	758,350	2,050	477,150	1,300
Champagnolle	3,680,850	10,050	2,790,700	7,650
Others	37,650	100	36,500	100
Total	32,091,600	87,700	25,372,700	69,500
COASTAL TEXAS				
West Columbia	2,946,550	8,050	2,380,500	6,500
Damon Mound	363,150	1,000	243,150	650
Big Creek	837,600	2,300	1,451,250	4,000
Boling	829,100	2,250	608,700	1,650
Blue Ridge	2,303,100	6,300	1,220,400	3,350
Pierce Junction	3,980,400	10,850	5,229,400	14,350
Humble	684,150	1,850	3,050,700	8,350
Goose Creek	2,552,950	6,950	2,140,200	5,850
South Liberty	1,437,650	3,950	2,248,300	6,150
Hull	4,166,850	11,400	3,444,050	9,450
Saratoga	379,200	1,050	346,200	950
Batson	498,550	1,350	495,850	1,350
Sour Lake	1,235,350	3,400	984,550	2,700
Spindletop	14,020,950	38,300	9,922,450	27,200
Orange Co.	1,473,100	4,000	1,058,250	2,900
Barber's Hill	323,000	900	4,477,750	12,250
Sugarland	270,950	750	3,989,250	10,950
Raccoon Bend	.....	.....	2,103,200	5,750
Somerville	.....	.....	672,250	1,850
Fannett Co.	.....	.....	174,850	500
North Dayton	.....	.....	43,200	100
Port Neches	.....	.....	51,950	150
Others	1,041,050	2,850	1,784,350	4,900
Total	39,343,650	107,500	48,120,750	131,850

GROSS PRODUCTION OF OIL BY FIELDS—(*Continued*)

	1928		1929	
	Total barrels	Daily average barrels	Total barrels	Daily average barrels
COASTAL LOUISIANA				
Vinton	1,637,950	4,450	1,560,350	4,250
Lockport	1,493,500	4,100	1,421,400	3,900
Evangeline	371,050	1,000	579,250	1,600
Edgerly	431,250	1,200	284,250	800
Sorrento Dome	277,300	750	121,800	350
East Hackberry	1,181,050	3,250	1,165,800	3,200
Old Hackberry	.....	.....	736,800	2,000
Sweet Lake	677,750	1,850	95,050	250
Sulphur Dome	801,050	2,200	1,334,850	3,650
Others	733,900	2,000	519,400	1,400
Total	7,604,800	20,800	7,818,950	21,400
Total Gulf Coast	46,948,450	128,300	55,939,700	153,250
EASTERN				
Eastern, total	40,315,500	110,150	44,752,250	122,600
WYOMING				
Salt Creek	14,195,950	38,800	11,591,250	31,750
Grass Creek	890,650	2,450	811,550	2,200
Elk Basin	377,350	1,050	281,850	800
Big Muddy	980,350	2,700	827,600	2,250
Lost Soldier	1,419,300	3,850	1,298,950	3,550
Rock River	935,900	2,550	860,050	2,350
Lance Creek	205,100	550	84,950	250
Labarge	.....	.....	708,450	1,950
Oregon Basin	521,350	1,400	1,458,900	4,000
Others	1,872,750	5,100	1,464,450	4,000
Total	21,398,700	58,450	19,388,000	53,100
MONTANA				
Cat Creek	617,950	1,700	500,200	1,350
Sunburst	3,163,150	8,650	2,401,400	6,600
Pondera	140,950	350	1,001,300	2,750
Others	70,650	200	23,750	50
Total	3,992,700	10,900	3,926,650	10,750
COLORADO				
Moffat (Craig)	457,650	1,250	440,450	1,200
Fort Collins	976,600	2,700	829,550	2,300
Florence	425,500	1,150	345,500	950
Others	789,000	2,150	756,600	2,050
Total	2,648,750	7,250	2,372,100	6,500

GROSS PRODUCTION OF OIL BY FIELDS—(*Continued*)

	1928		1929	
	Total barrels	Daily average barrels	Total barrels	Daily average barrels
NEW MEXICO				
Table Mesa	44,100	100	32,850	100
Hogback	166,900	450	118,850	350
Bal. Lea & Eddy Co.'s	.....	.....	374,100	1,000
Artesia	419,750	1,150	324,150	900
Rattlesnake	246,000	700	405,100	1,100
Others	68,100	200	140,550	400
Total	944,850	2,600	1,395,600	3,850
Total Rocky Mt.	28,985,000	79,200	27,082,350	74,200
CALIFORNIA				
Santa Fe Springs	16,022,900	43,800	76,446,900	209,450
Long Beach	62,530,500	170,850	60,327,000	165,300
Huntington Beach	19,998,300	54,650	16,142,600	44,200
Torrance	6,484,300	17,700	3,642,600	10,000
Dominguez	4,220,000	11,550	3,494,400	9,550
Rosecrans	2,325,700	6,350	1,697,900	4,650
Inglewood	10,676,400	29,150	8,833,600	24,200
Midway Sunset	27,537,500	75,250	25,603,000	70,150
Ventura Ave	18,834,100	51,450	20,897,000	57,250
Seal Beach	12,413,100	33,900	13,991,000	38,350
Elwood-Goleta	.....	.....	9,643,100	26,400
Kettleman Hills	.....	.....	2,001,800	5,500
Others	51,501,900	140,700	49,600,800	135,900
Total	232,544,700	635,350	292,321,700	800,900

Authority: American Petroleum Institute.

Production of Crude Oil in the United States, by States

(Thousands of Barrels of 42 U. S. Gallons)

Year	New York	Pennsylvania	West Virginia	Kentucky	Ohio	Indiana	Illinois	Kansas	Oklahoma	Texas	Wyoming	Colorado	California	Louisiana	Tennessee	Montana	Arkansas	Others	Total United States
1859	....	2	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	2
1860	....	500	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	500
1861	....	2,114	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	2,114
1862	....	3,057	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	3,057
1863	....	2,611	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	2,611
1864	....	2,116	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	2,116
1865	....	2,498	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	2,498
1866	....	3,598	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	3,598
1867	....	3,347	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	3,347
1868	....	3,646	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	3,646
1869	....	4,215	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	4,215
1870	....	5,261	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	5,261
1871	....	5,205	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	5,205
1872	....	6,293	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	6,293
1873	....	9,894	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	9,894
1874	....	10,927	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	10,927
1875	....	8,788	....	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	8,788
1876	....	8,969	120	....	32	....	....	....	....	....	....	....	12	....	..	....	....	....	9,133
1877	....	13,135	172	....	30	....	....	....	....	....	....	....	13	....	..	....	....	....	13,350
1878	....	15,164	180	....	38	....	....	....	....	....	....	....	15	....	..	....	....	....	15,397
1879	....	19,685	180	....	29	....	....	....	....	....	....	....	20	....	..	....	....	....	19,914
1880	....	26,028	179	....	39	....	....	....	....	....	....	....	40	....	..	....	....	....	26,286
1881	....	27,376	151	....	34	....	....	....	....	....	....	....	100	....	..	....	....	....	27,661
1882	6,685	23,368	128	....	40	....	....	....	....	....	....	....	129	....	..	....	....	....	30,350
1883	4,004	19,125	126	5	47	....	....	....	....	....	....	....	143	....	..	....	....	....	23,450
1884	3,231	20,541	90	4	90	....	....	....	....	....	....	....	262	....	..	....	....	....	24,218
1885	2,658	18,118	91	5	662	....	....	....	....	....	....	....	325	....	..	....	....	....	21,859
1886	2,151	23,647	102	5	1,782	....	....	....	....	....	....	....	377	....	..	....	....	....	28,065
1887	2,075	20,281	145	5	5,023	....	....	....	....	....	....	76	678	....	..	....	....	....	28,283
1888	....	16,489	119	5	10,011	....	....	....	....	....	....	298	690	....	..	....	....	....	27,612
1889	1,897	19,591	544	5	12,472	33	2	1	....	....	....	317	303	....	..	....	....	....	35,164
1890	....	28,458	493	6	16,125	64	1	1	....	....	....	369	307	....	..	....	....	....	45,824
1891	1,585	31,424	2,406	9	17,740	137	1	2	....	....	....	666	324	....	..	....	....	....	54,293
1892	1,273	27,149	3,810	7	16,363	698	1	5	....	....	....	824	385	....	..	....	....	....	50,515
1893	1,032	19,283	8,446	3	16,249	2,335	1	18	....	....	....	594	470	....	..	....	....	....	48,431
1894	942	18,078	8,577	2	16,792	3,689	....	40	....	....	2	516	706	....	....	....	....	....	49,344
1895	913	18,231	8,120	2	19,545	4,386	....	44	....	....	4	438	1,209	....	..	....	....	....	52,892

PRODUCTION OF CRUDE OIL IN THE UNITED STATES, BY STATES—(*Continued*)

(Thousands of Barrels of 42 U. S. Gallons)

Year	New York	Pennsylvania	West Virginia	Kentucky	Ohio	Indiana	Illinois	Kansas	Oklahoma	Texas	Wyoming	Colorado	California	Louisiana	Tennessee	Montana	Arkansas	Others	Total United States
1896	1,205	19,379	10,020	2	23,941	4,681	....	114	....	1	3	361	1,253	....	..	....	....	....	60,960
1897	1,279	17,983	13,090	....	21,561	4,122	1	81	1	66	4	385	1,903	....	..	....	....	....	60,476
1898	1,205	14,743	13,615	6	18,739	3,731	....	72	....	546	6	444	2,357	....	..	....	....	....	55,364
1899	1,321	13,054	13,911	18	21,142	3,848	....	70	....	669	6	390	2,642	....	..	....	....	....	57,071
1900	1,301	13,258	16,196	62	22,363	4,874	....	75	6	836	6	317	4,325	....	..	....	....	2	63,621
1901	1,207	12,625	14,177	137	21,648	5,757	....	179	10	4,394	5	461	8,787	....	..	....	....	2	69,389
1902	1,120	12,064	13,513	185	21,014	7,481	....	332	37	18,084	6	397	13,984	549	..	....	....	1	88,767
1903	1,163	11,355	12,900	554	20,480	9,186	....	932	139	17,956	9	484	24,382	918	..	....	....	3	100,461
1904	1,113	11,126	12,645	998	18,877	11,339	....	4,251	1,367	22,241	12	501	29,649	2,959	..	....	....	3	117,081
1905	1,118	10,437	11,578	1,217	16,347	10,964	181	12,014	....	28,136	8	376	33,428	8,910	..	....	....	3	134,717
1906	1,243	10,257	10,121	1,214	14,788	7,674	4,397	21,718	....	12,568	7	328	33,099	9,077	..	....	....	3	126,494
1907	1,212	10,000	9,095	821	12,207	5,128	24,282	2,410	43,524	12,323	9	332	39,748	5,000	..	....	....	4	166,095
1908	1,160	9,424	9,523	728	10,859	3,283	33,686	1,801	45,799	11,207	18	380	44,855	5,789	..	....	....	15	178,527
1909	1,135	9,299	10,745	639	10,633	2,296	30,898	1,264	47,859	9,534	20	311	55,472	3,060	..	....	....	6	183,171
1910	1,054	8,795	11,753	469	9,916	2,160	33,143	1,128	52,029	8,899	115	240	73,011	6,841	..	....	....	4	209,557
1911	953	8,248	9,796	472	8,817	1,695	31,317	1,279	56,069	9,526	187	227	81,134	10,721	..	....	....	8	220,449
1912	874	7,383	12,129	484	8,969	970	28,602	1,593	51,427	11,735	1,572	206	87,269	9,263	..	....	....	4	222,935
1913	948	7,917	11,567	525	8,781	956	23,894	2,375	63,579	15,010	2,407	189	97,788	12,499	..	....	....	11	248,446
1914	939	8,170	9,680	503	8,536	1,336	21,920	3,104	73,632	20,068	3,560	223	99,775	14,309	..	....	....	8	265,763
1915	888	7,838	9,265	437	7,825	876	19,042	2,823	97,915	24,943	4,246	208	86,592	18,192	..	....	....	14	281,104
1916	874	7,593	8,731	1,202	7,744	769	17,714	8,738	107,072	27,645	6,234	197	90,952	15,248	1	45	....	8	300,767
1917	880	7,733	8,379	3,088	7,751	760	15,777	36,536	107,508	32,413	8,978	121	93,878	11,392	12	100	....	10	335,316
1918	809	7,408	7,867	4,368	7,368	878	13,366	45,451	103,347	38,750	12,596	143	97,532	16,043	8	69	....	8	355,921
1919	851	8,137	8,327	9,278	7,736	972	11,960	33,048	86,911	79,366	13,172	121	101,183	17,188	15	90	....	12	378,367
1920	906	7,438	8,249	8,738	7,400	945	10,774	39,005	106,206	96,868	16,831	111	103,377	35,714	14	340	....	13	442,929
1921	988	7,418	7,822	9,013	7,335	1,158	10,043	36,456	114,634	106,166	19,333	108	112,600	27,103	12	1,509	10,473	12	472,183
1922	1,000	7,425	7,021	8,973	6,781	1,087	9,383	31,766	149,571	118,684	26,715	97	138,468	35,376	9	2,449	12,712	13	557,531
1923	1,250	7,609	6,358	8,069	7,085	1,043	8,707	28,250	160,929	131,023	44,785	86	262,876	24,919	8	2,782	36,610	18	732,407
1924	1,440	7,486	5,920	7,407	6,811	935	8,081	28,836	173,538	134,522	39,498	445	228,933	21,124	10	2,815	46,028	13	713,940
1925	1,695	8,097	5,763	6,759	7,212	829	7,863	38,357	176,768	144,648	29,173	1,226	232,492	20,272	24	4,091	77,398	[2]1,076	763,743
1926	1,956	8,961	5,946	6,274	7,272	808	7,760	41,498	179,195	166,916	25,776	2,768	224,673	23,201	43	7,727	58,332	[2]1,768	770,874
1927	2,242	9,526	6,023	6,719	7,593	852	6,994	41,069	277,775	217,389	21,307	2,831	231,196	22,818	60	5,058	40,005	1,672	901,129
1928	2,603	9,956	5,661	7,359	7,015	1,052	6,462	38,596	249,837	257,320	21,461	2,774	231,811	21,847	46	4,015	32,096	1,543	901,474
1929	3,346	11,805	5,587	7,776	6,708	977	6,304	42,875	253,704	298,441	19,190	2,298	292,037	20,229	19	3,183	25,076	6,043	1,005,598

[1] Less than 1,000 barrels.

[2] Includes New Mexico, which in 1925 produced 1,060,000 barrels and in 1926, 1,666,000 barrels; also Michigan production in 1925, 4,000 barrels and in 1926, 94,000 barrels.

Authority: U. S. Bureau of Mines

TRANSPORTATION AND STORAGE OF OIL IN THE UNITED STATES

PETROLEUM PIPE LINES

At the present time there is in the United States a petroleum pipe line system probably exceeding 100,000 miles. The Interstate Commerce Commission reports for interstate pipe lines alone a mileage of 85,796 miles at the end of 1929, representing an investment of $741,010,196.

INTERSTATE PIPE LINES

December 31	Miles of line operated	Investment in pipe lines
1921	55,260	$365,024,499
1922	57,349	382,279,598
1923	64,760	432,065,360
1924	68,185	496,187,164
1925	70,008	511,087,922
1926	72,840	539,409,607
1927	76,070	609,438,885
1928	81,676	659,092,738
1929	85,796	741,010,196

Authority: Compiled from reports made to Interstate Commerce Commission.

A survey of the petroleum pipe lines by the U. S. Bureau of Mines, as of May 1, 1926, shows that on that date there was a total of slightly more than 90,000 miles of pipe lines in the United States, having a capacity of approximately 15,750,000 barrels. These lines varied in diameter from 2 to 16 inches, the weighted average being 6 inches.

The total pipe line mileage, according to the U. S. Bureau of Mines' survey, was about equally divided between trunk lines and gathering lines, though the capacity of the former was about four times that of the latter.

STORAGE OF CRUDE OIL AND PRODUCTS

The grand total of tankage (according to a survey made by the U. S. Bureau of Mines), exclusive of producers' storage at the wells, available in the United States for the storage of crude petroleum and of petroleum products at refineries, on May 1, 1926, amounted to over 800,000,000 barrels of 42 U. S. gallons. The total is given as 815,994,000 barrels; but, owing to the fact that some types of crude storage equipment are moved from place to place as old fields decline and new fields come in, and also owing to new construction and abandonment of old construction, it is advisable to consider the total in round numbers only.

In addition to the tank capacity, the pipe lines of the country have a capacity of 16,000,000 barrels. For it is a feature of pipe line transportation that the lines to be operating must always be full of oil; in other words, there are always about 16,000,000 barrels of oil in permanent pipe line storage.

On May 1, 1926, there were 530,000,000 barrels (net) of oil (410,000,000 barrels of crude petroleum and 120,000,000 barrels of refined oils) held in tank farms, in pipe lines, and at refineries. There were also approximately 20,000,000 barrels of liquid in storage, indicating the utilization of 66 per cent of total capacity. Of the total tank capacity, nearly 500,000,000 barrels were at tank farms and over 300,000,000 barrels at refineries. Of the latter, 80,000,000 barrels was crude oil storage.

Tank farm storage comprised by far the major portion of the total capacity for crude petroleum of the country, and also the major portion of the total capacity of all oils. This type of storage includes tanks on farms and along pipe lines, but does not include crude storage at refineries or on producing properties. Owing to incomplete information, storage on producing properties, which is estimated as 10,000,000 barrels, is not considered in this survey.

There are four types of storage, viz., steel, wooden, earthen, and concrete. Steel storage is by far the most widely used, and comprises 80 per cent of the total. The remainder is about evenly divided between earthen and concrete storage, with wooden storage almost negligible.

PETROLEUM FREIGHT CARRIED BY RAILROADS

Petroleum ranks first among rail shipments of manufactured products, both crude oil and refined products being shipped by rail, although the bulk of crude oil is moved by pipe line and tank vessel. How materially petroleum has contributed to the growth of business of railroads is shown in the following table:

PETROLEUM AND PRODUCTS TRANSPORTED BY RAILROADS

Year	Crude oil tons	Refined products tons
1920	6,401,572	29,621,187
1921	6,044,513	27,621,187
1922	5,935,997	30,863,324
1923	8,335,653	36,401,305
1924	8,411,660	41,297,561
1925	11,245,000	46,273,000
1926	10,740,000	48,938,000
1927	10,548,000	51,663,000
1928	7,632,000	56,777,000
1929	6,630,000	46,091,000

Authority: Interstate Commerce Commission.

TANK CARS IN PETROLEUM SERVICE

The rail movement of crude oil and petroleum products is handled by tank cars. Most of the cars in petroleum service are owned by the petroleum industry, the railroads thus being saved the capital requirements represented by ownership and maintenance of this equipment. In 1914 as few as 41,000 tank cars took care of the rail shipment of petroleum. In 1930 there are 153,735 cars in petroleum service.

TANK CARS IN PETROLEUM SERVICE

January 1	Privately owned	Railroad owned	Total
1914	30,764	10,462*	41,226
1915	31,541	10,514*	42,055
1916	35,348	11,723*	47,071
1917	43,734	13,287*	57,021
1918	60,014	12,217*	72,231
1919	70,601	13,094*	83,695
1920	82,898	13,282*	96,180
1921	105,071	13,766*	118,837
1922	114,829	14,136*	128,965
1923	118,926	12,685	131,611
1924	126,031	13,110	139,141
1925	125,862	13,451	139,313
1926	128,797	12,685	141,482
1927	130,913	13,985	144,898
1928	141,346	15,950	157,296
1929	141,594	9,160	150,754
1930	145,585	8,150	153,735

Authority: Compiled from Railway Equipment Register.
* Includes cars in services other than petroleum.

TRANSPORTATION BY TANK VESSELS

The tank vessel has become an increasingly important transportation agency for carrying both crude oil and refined products in domestic trade and in foreign trade. The principal movements of American tank vessels (for tanker statistics see "World Transportation of Petroleum") are in the carrying of crude oil from Mexico and northern South American countries to refinery points in the United States; in the carrying of Mid Continent crude oil and refined products from Mid Continent and Gulf Coast refineries to the Atlantic seaboard refineries and markets, and to foreign markets; in the carrying of crude oil and refined products from California through the Panama Canal to eastern points and abroad; while there is an unceasing movement of tankers carrying refined products from coastal refinery points in the United States to the markets of the world.

The enormous petroleum traffic through the Panama Canal in recent years has had no small part in the canal's financial success.

SHIPMENTS OF CALIFORNIA OIL THROUGH PANAMA CANAL

(Thousands of Barrels)

	1925	1926	1927	1928	1929
Crude Oil	14,545	11,104	10,692	2,301	1,299
Refined products:					
Gasoline	10,280	8,453	11,675	16,779	23,483
Tops	1,577	244	....	339	....
Gas oil	828	5,800	4,197	2,504	3,864
Fuel oil	821	8,115	7,010	848	179
Lubricants	526	557	355	335	182
Asphalt	....	14	17	29	28
Kerosene	....	....	24	1	229
Total refined	14,032	23,163	23,328	20,835	27,965
Total	28,577	34,267	34,020	23,136	29,264

Authority: U. S. Bureau of Mines.
NOTE.—Figures are approximate.

Tank vessels paid $5,145,632 in canal tolls for the fiscal year 1929. Tank ships comprised 16.9 per cent of the total commercial transits during the year; made up 19.6 per cent of the Panama Canal net tonnage; paid 18.9 per cent of the total tolls collected, and carried 17.9 per cent of the cargo which passed through the canal.

Omitting transits of public vessels of the United States and other vessels exempt from the payment of tolls, the number of ocean-going vessels transiting the canal daily averaged 17.5 throughout the year. Of this number, tank ships averaged 2.9 transits daily, the balance of 14.6 being made up of general cargo carriers, passenger ships, warships of foreign nations, etc.

In the following tables, the commercial traffic has been segregated to show the proportion of tanker transits, tonnage, and tolls, as compared with corresponding figures embracing all other classes of traffic. The figures are for the fiscal years 1923 to 1929, inclusive, covering the era of the growth and decline of tanker traffic:

PROPORTION OF TANK SHIPS TO TOTAL TRAFFIC

Year	Total commercial transits			Average daily transits		
	Tankers	General	Total	Tankers	General	Total
1923	913	3,054	3,967	2.5	8.3	10.8
1924	1,704	3,526	5,230	4.6	9.6	14.2
1925	1,079	3,594	4,673	2.9	9.8	12.8
1926	1,090	4,107	5,197	3.0	11.2	14.2
1927	1,324	4,151	5,475	3.6	11.4	15.0
1928	1,121	5,335	6,456	3.0	14.6	17.6
1929	1,083	5,330	6,413	2.9	14.6	17.5

PROPORTION OF TANKER TONNAGE TO TOTAL TONNAGE

Fiscal year	Panama Canal net tonnage			Percentage of total net tonnage		
	Tankers	General	Total	Tankers	General	Total
1923	5,374,384	13,231,402	18,605,786	28.9	71.1	100
1924	10,212,047	15,936,831	26,148,878	39.1	60.9	100
1925	6,424,622	16,430,529	22,855,151	28.1	71.9	100
1926	6,324,240	18,431,351	24,774,591	25.5	74.5	100
1927	7,624,112	18,603,703	26,227,815	29.1	70.9	100
1928	6,243,969	23,214,665	29,458,634	21.2	78.8	100
1929	5,844,263	23,993,531	29,837,794	19.6	80.4	100

PROPORTION OF TOLLS FROM TANK SHIPS TO TOTAL TOLLS FROM ALL VESSELS

Fiscal year	Tolls paid by shipping using canal			Percentage of total tolls		
	Tankers	General	Total	Tankers	General	Total
1923	$4,769,324.63	$12,738,874.94	$17,508,199.57	27.2	72.8	100
1924	9,071,835.65	15,219,127.89	24,290,963.54	37.3	62.7	100
1925	5,728,302.26	15,672,221.25	21,400,523.51	26.8	73.2	100
1926	5,626,167.93	17,304,888.05	22,931,055.98	24.4	75.6	100
1927	6,658,806.90	17,570,023.21	24,228,830.11	27.5	72.5	100
1928	5,436,437.16	21,508,062.61	26,944,499.77	20.1	79.9	100
1929	5,145,632.19	21,981,744.72	27,127,376.91	18.9	81.1	100

Authority: The Panama Canal

PIPE LINES FOR THE TRANSPORTATION OF GASOLINE

The transportation of gasoline by pipe line in this country was recently inaugurated. The first application of this

method utilized lines which had been transporting crude oil; and, more recently, entirely new lines for the shipment of gasoline have been built. These lines transport gasoline from refineries to the large consuming centers, obviating the use of tank cars, and at the same time enabling the refineries to ship much greater quantities in a shorter time and at less cost than would be involved were shipments made by rail.

REFINERIES AND REFINING IN THE UNITED STATES

GROWTH OF PETROLEUM REFINING

The modern petroleum industry began in 1859, when Drake drilled the first oil well in Pennsylvania. Before Drake's time kerosene had been refined and kerosene lamps had been invented, but the kerosene of those days was distilled from coal or shales, or from the skimmings of oil springs. There were a half-dozen refineries in Pittsburgh, and a half-hundred in the country, before the Drake well was drilled. Machine drilling for oil brought about enlargement of petroleum supply, and kerosene from petroleum came into universal use for illumination.

For many years kerosene was the principal product manufactured from crude oil. It was not until some 20 years ago that gasoline became the chief product in demand, due to the development of the automobile. The Census Bureau reported 78 refineries in the United States in 1859. These were small plants, scarcely indicative of the vast industrial establishment represented by the more modern refinery. There are now 412 completed refineries in this country.

REFINERIES IN UNITED STATES

	Building		Completed	
	Number	Daily capacity barrels	Number	Daily capacity barrels
January 1, 1914*	..	.....	176	.....
January 1, 1918	..	.....	267	1,186,155
January 1, 1919	..	.....	289	1,295,115
January 1, 1920	99	263,500	373	1,530,565
January 1, 1921	44	76,600	415	1,888,800
January 1, 1922	30	59,950	479	2,109,200
November 1, 1924	8	18,200	547	2,814,332
January 1, 1925	6	37,000	541	2,827,837
May 1, 1925	4	11,000	550	2,853,842
January 1, 1926	2	5,500	510	2,852,967
January 1, 1927	7	61,000	466	3,061,007
January 1, 1928	5	22,000	423	3,250,380
January 1, 1929	14	99,000	413	3,509,540
January 1, 1930	8	37,200	412	3,765,585

* From the U. S. Bureau of the Census. Authority: U. S. Bureau of Mines.

States in which Refineries are Located (January 1, 1930)

State	Number				Capacity (barrels per day)			
	Operating	Shut down	Building	Total	Operating	Shut down	Building	Total
Arizona	1	..	..	1	1,000	.....	.....	1,000
Arkansas	8	1	..	9	41,500	5,500	.....	47,000
California	53	9	..	62	888,730	26,050	.....	914,780
Colorado	3	..	..	3	4,100	.....	.....	4,100
Georgia	1	..	1	2	5,000	.....	3,000	8,000
Illinois	12	..	..	12	137,500	.....	.....	137,500
Indiana	4	..	1	5	160,000	.....	15,000	175,000
Iowa	1	..	..	1	3,500	.....	.....	3,500
Kansas	14	4	..	18	130,000	11,500	.....	141,500
Kentucky	8	..	..	8	28,260	.....	.....	28,260
Louisiana	13	1	..	14	217,380	20,000	.....	237,380
Maryland	3	1	..	4	50,000	6,000	.....	56,000
Massachusetts	2	..	..	2	42,000	.....	.....	42,000
Michigan	5	1	..	6	13,500	500	.....	14,000
Missouri	2	..	..	2	16,000	.....	.....	16,000
Montana	13	6	1	20	18,800	5,400	1,500	25,700
New Jersey	7	..	..	7	307,500	.....	.....	307,500
New Mexico	3	3	..	6	2,550	3,100	.....	5,650
New York	4	..	..	4	34,500	.....	.....	34,500
Ohio	12	..	1	13	86,280	.....	8,000	94,280
Oklahoma	43	8	1	52	287,500	16,050	5,000	308,550
Pennsylvania	46	5	..	51	225,700	4,880	.....	230,580
Rhode Island	2	..	..	2	11,500	.....	.....	11,500
South Carolina	1	..	..	1	15,000	.....	.....	15,000
Tennessee	..	1	..	1	.....	500	.....	500
Texas	78	12	1	91	773,275	30,280	4,000	807,555
Utah	1	1	..	2	6,000	250	.....	6,250
Virginia	1	..	..	1	1,500	.....	.....	1,500
West Virginia	5	..	..	5	14,500	.....	.....	14,500
Wyoming	12	1	2	15	111,750	750	700	113,200
Total	358	54	8	420	3,634,825	130,760	37,200	3,802,785

Authority: U. S. Bureau of Mines

PRODUCTS FROM A BARREL OF CRUDE OIL

Petroleum is a mixture of many hydrocarbons, which boil and vaporize at different temperatures. When a quantity is introduced into a still and subjected to gradually increasing heat, the lightest elements rise and escape as vapor, precisely as steam escapes from the spout of a tea kettle. These vapors are then condensed. The lightest to come off are the naphthas and gasoline; then, at a somewhat higher temperature, kerosene vaporizes, and is in turn condensed. Next come the still heavier oils, which ultimately become lubricants, paraffin and various other products. In the refining of asphaltic crude, the asphalt will not distill over, and is left as residue in the still and is then recovered for commercial use. Such is a simple statement of the bare elements in the process commonly known as " straight run " refining.

In response to changing demands for different petroleum products, refining operations have had to be adjusted so that the products in greatest demand could be supplied in sufficient quantity. The most striking and revolutionary adjustment came with the tremendously increasing requirements for gasoline, previously a waste product.

By improvements and new processes—among the latter the " cracking " of gas oil and fuel oil to make gasoline—the industry has been able greatly to increase the yield of gasoline. The yield of gas oil and fuel oil, however, is the largest of any product, and a market has had to be found for it, largely in competition with coal.

In 1899 only 5.4 gallons of gasoline were derived from a 42-gallon barrel of crude oil run through American refineries. On the other hand, 24.2 gallons of kerosene were produced (kerosene being the product then in principal demand), together with 5.9 gallons of gas and fuel oil, and 3.8 gallons of lubricating oil. Today 16.5 gallons of gasoline are derived; only 2.4 gallons of kerosene; 19.1 gallons of gas and fuel oil; and 1.5 gallons of lubricating oil. How the petroleum industry has squeezed more gasoline out of a barrel of crude oil is indicated in the following table:

PRINCIPAL PRODUCTS YIELDED FROM 42-GALLON BARREL OF CRUDE OIL

Year	Gasoline gallons	Kerosene gallons	Gas and fuel oil gallons	Lubricating oil gallons
1899	5.4	24.2	5.9	3.2
1909	4.5	13.9	14.1	4.5
1919	10.8	6.5	20.4	2.4
1926	14.7	3.3	19.7	1.7
1927	15.1	2.9	19.9	1.6
1928	15.7	2.8	19.6	1.6
1929	16.5	2.4	19.1	1.5

PRINCIPAL PETROLEUM PRODUCTS YIELDED FROM 42-GALLON BARREL OF CRUDE OIL AVERAGES FOR THE UNITED STATES

Year	Gasoline and naphtha		Kerosene		Gas and fuel oil		Lubricants	
	Per cent	Gallons	Per cent	Gallons	Per cent	Gallons	Per cent	Gallons
1880.....	10.3	4.3	75.2	31.6	...	...	2.1	0.9
1889.....	12.8	5.4	65.9	27.7	...	...	7.7	3.2
1899.....	12.9	5.4	57.6	24.2	14.0	5.9	9.1	3.8
1904.....	10.3	4.3	48.3	20.3	12.8	5.4	11.6	4.9
1909.....	10.7	4.5	33.0	13.9	33.6	14.1	10.7	4.5
1914.....	18.2	7.6	24.1	10.1	46.5	19.5	6.6	2.8
1917.....	21.5	9.0	13.1	5.5	49.2	20.7	5.7	2.4
1918.....	25.3	10.6	13.3	5.6	53.5	22.5	6.2	2.6
1919.....	25.2	10.8	15.4	6.5	50.2	21.1	5.6	2.4
1920.....	26.1	11.0	12.7	5.3	48.6	20.4	5.7	2.4
1921.....	27.1	11.4	10.5	4.4	51.9	21.8	4.7	2.0
1922.....	28.8	12.1	11.0	4.6	50.9	21.4	4.7	2.0
1923.....	30.0	12.6	9.6	4.0	49.5	20.4	4.5	1.9
1924.....	31.2	13.1	9.3	4.0	49.8	20.9	4.3	1.8
1925.....	32.4	13.6	8.1	3.4	49.3	20.7	4.2	1.8
1926.....	34.9	14.7	7.9	3.3	46.9	19.7	4.1	1.7
1927.....	36.0	15.1	6.8	2.9	47.4	19.9	3.8	1.6
1928.....	37.4	15.7	6.6	2.8	46.7	19.6	3.8	1.6
1929.....	39.4	16.5	5.8	2.4	45.4	19.1	3.5	1.5

Authorities: Basic data taken from Bureau of Census Reports for years 1880 to 1914, inclusive, and from Bureau of Mines Reports for 1917 to 1924, inclusive.

GASOLINE FROM CRUDE OIL

Less crude oil is being produced in the United States per automobile registered than in 1918, although petroleum production has increased from 355,928,000 barrels annually in 1918 to 1,006,000,000 barrels in 1929.

At the end of 1918 there were 6,147,000 motor vehicles registered, and the production of oil amounted to 57.9 barrels per car. At the end of 1929 there were 26,501,000 motor vehicles registered, and the oil production in 1929 amounted to 38 barrels per car.

Superficially, it would seem that crude oil production has not been able to keep pace with automotive demand, despite

the enormous increase in output shown. But this is not the case, for scientific discoveries and improvements in refining now make the crude oil go farther by greatly increasing the yield of gasoline. The " cracking " process is largely responsible.

CRUDE OIL AVAILABLE PER AUTOMOBILE IN THE UNITED STATES

Year	Crude oil produced barrels	Motor vehicles registered end of year	Oil available per car barrels
1918	355,928,000	6,147,000	57.9
1919	378,367,000	7,565,000	50.0
1920	442,929,000	9,232,000	48.0
1921	472,183,000	10,463,000	45.1
1922	557,531,000	12,238,000	45.6
1923	732,407,000	15,092,000	48.5
1924	713,940,000	17,594,000	40.6
1925	763,743,000	19,954,000	38.3
1926	770,874,000	22,001,000	35.0
1927	901,129,000	23,133,000	39.0
1928	901,474,000	24,493,000	36.8
1929	*1,006,000,000	26,501,000	38.0

* Preliminary.

GASOLINE PRODUCTION BY DIFFERENT METHODS
(Thousands of Barrels)

Refining districts	Straight run refining		Cracking		Natural gas gasoline run through refineries		Total	
	Barrels	Per cent	Barrels	Per cent	Barrels	Per cent	Barrels	Per cent
East Coast	29,700	55.3	21,790	40.6	2,204	4.1	53,694	100.0
Appalachian	10,583	66.6	4,579	28.8	732	4.6	15,894	100.0
Ind.-Ill.	30,211	54.2	23,279	41.8	2,226	4.0	55,716	100.0
Okla.-Kansas	36,553	60.0	19,758	32.4	4,632	7.6	60,943	100.0
Texas	43,051	53.2	30,849	38.2	6,963	8.6	80,863	100.0
Louisiana-Ark.	13,439	50.4	8,141	30.5	5,082	19.1	26,662	100.0
Rocky Mountain	8,333	50.5	6,780	41.1	1,384	8.4	16,497	100.0
California	47,567	71.1	7,205	10.8	12,142	18.1	66,914	100.0
Total, 1928	219,437	58.2	122,381	32.4	35,365	9.4	377,183	100.0
Total, 1927	197,047	59.6	101,226	30.7	32,162	9.7	330,435	100.0
Texas, La., Gulf Coast	39,581	47.9	33,587	40.6	9,557	11.5	82,725	100.0

INCREASED RECOVERY OF GASOLINE

Since " cracking " was first applied some fifteen years ago, it has been widely adopted and has become one of the guarantees of adequate future supplies of motor fuel. As

recently as 1914, less than one-fifth of the barrel of crude oil was made into gasoline. With "cracking," the proportion rose steadily, until in 1929 over 39 per cent of all crude oil became gasoline.

In 1914 the percentage yield of gasoline was 18.2. By 1917 it had increased to 21.5 per cent. The average gasoline yield on straight refining is about 25 per cent, and the result of cracking operations is clearly shown since 1918 by the steady increase above that figure year after year.

The trend of gasoline yield from a barrel of crude oil since the advent of "cracking" is shown in the following table:

PERCENTAGE YIELD OF GASOLINE FROM CRUDE OILS RUN BY U. S. REFINERIES

Year	Per cent	Year	Per cent
1914	18.2	1923	30.0
1917	21.5	1924	31.2
1918	25.3	1925	32.4
1919	25.2	1926	34.9
1920	26.1	1927	36.0
1921	27.1	1928	37.4
1922	28.8	1929	39.4

GASOLINE FROM CRACKING OPERATIONS

"CRACKED" GASOLINE PRODUCTION

It is estimated that, in 1918, 500,000 barrels of "cracked" gasoline were produced by refineries in the United States. In 1929 there were 143,759,000 barrels produced, almost equal to the entire production of gasoline in 1922.

ESTIMATED PRODUCTION OF GASOLINE FROM CRACKING

Year	Barrels	Year	Barrels
1918	8,500,000	1924	40,000,000
1919	10,000,000	1925*	68,582,000
1920	15,000,000	1926*	93,736,000
1921	20,000,000	1927*	101,226,000
1922	30,000,000	1928*	122,554,000
1923	35,000,000	1929*	143,759,000

*U. S. Bureau of Mines figures; other years estimated.

WHAT " CRACKED " GASOLINE HAS MEANT TO MOTORISTS

Without the supply of gasoline obtained from " cracking " operations, the use of automobiles could probably not have expanded to its present proportions because of lack of fuel.

The average yearly consumption of gasoline per motor vehicle over the last ten-year period is estimated as 475 gallons. On this basis, " cracked " gasoline supplied the fuel for 12,711,000 motor vehicles in 1928; that is, for as many cars as the total number in operation in this country in 1922. The following table shows the estimated annual production of " cracked " gasoline and what it represents in number of motor vehicles supplied with fuel:

Year	" Cracked " gasoline production barrels	Number of motor vehicles supplied
1923	35,000,000	3,100,000
1924	40,000,000	3,500,000
1925	68,582,000	6,100,000
1926	93,736,000	8,300,000
1927	101,226,000	9,000,000
1928	122,554,000	10,800,000
1929	143,759,000	12,711,000

YIELD OF GASOLINE BY DIFFERENT METHODS

(Thousands of Barrels)

Year	Output of refineries barrels	Estimated amount from cracking barrels	Natural gas gasoline run through refineries barrels	Straight run gasoline barrels	Per cent from crude run
1914	34,763	*	*	*	*
1916	49,021	*	*	*	*
1917	67,870	*	*	*	*
1918	85,007	8,500	2,451	74,056	22.7
1919	94,235	10,000	2,957	81,288	22.5
1920	116,251	15,000	3,153	98,098	22.6
1921	122,704	20,000	2,517	100,187	22.6
1922	147,672	30,000	3,662	114,010	22.7
1923	179,903	35,000	5,487	139,416	24.0
1924	213,325	40,000	12,671	160,654	24.9
1925	259,601	68,582	19,636	171,383	23.2
1926	299,734	93,736	24,399	181,599	23.2
1927	330,435	101,226	32,162	197,047	23.8
1928	376,945	122,554	35,223	219,168	24.0
1929	434,241	143,759	45,463	245,019	24.8

* Not available.

Authorities: Figures in columns 1 and 3 are from U. S. Bureau of Mines Reports, except for the year 1914, which are from the Census Report of Manufactures. Figures in column 2 are estimates, except 1925 and 1926, which are from the U. S. Bureau of Mines.

CRUDE OIL RUN THROUGH UNITED STATES REFINERIES

(Thousands of Barrels)

Year	Domestic	Foreign	Total
1918	326,025	*	326,025
1919	361,520	*	361,520
1920	433,915	*	433,915
1921	443,363	*	443,363
1922	434,976	65,730	500,706
1923	538,252	42,986	581,238
1924	597,954	45,765	643,719
1925	698,582	41,338	739,920
1926	737,598	44,963	782,561
1927	778,729	50,106	828,835
1928	835,711	77,584	913,295
1929	912,191	75,517	987,708

* Runs not separated as to foreign or domestic crude prior to 1922.

Authority: U. S. Bureau of Mines.

Crude Oil Run by Refineries by Districts

(Thousands of Barrels)

Districts	1921	1922	1923	1924	1925	1926	1927	1928	1929
East Coast	96,846	100,525	116,759	135,202	128,491	130,643	150,559	170,506	172,434
Appalachian	19,289	20,661	21,352	21,958	25,118	28,502	28,941	33,643	33,802
Indiana-Illinois	38,338	45,606	51,276	56,399	67,159	69,707	75,807	98,905	110,349
Oklahoma-Kansas	63,387	70,934	70,289	79,701	97,612	96,506	101,871	111,342	115,449
Texas	91,928	100,696	103,374	125,025	144,282	156,110	167,095	186,076	211,693
Louisiana-Arkansas	31,419	34,865	40,806	49,417	66,997	71,012	70,444	75,540	75,428
Rocky Mountain	16,406	24,391	27,176	26,737	26,164	29,205	25,026	26,061	25,443
California	85,750	103,028	150,206	149,280	184,097	197,579	209,092	211,222	243,110
United States	443,363	500,706	581,238	643,719	739,920	779,264	828,835	913,295	987,708

Authority: U. S. Bureau of Mines.

Gasoline Yield of U. S. Refineries, by Refinery Districts

Districts	1921 Per cent	1922 Per cent	1923 Per cent	1924 Per cent	1925 Per cent	1926 Per cent	1927 Per cent	1928 Per cent	1929 Per cent
East Coast	25.1	27.5	28.4	27.3	29.8	32.4	31.1	30.2	32.1
Appalachian	32.6	34.2	34.8	36.4	39.0	40.0	40.9	45.1	45.6
Indiana-Illinois	45.3	46.0	46.3	47.9	50.3	55.5	55.1	54.1	56.6
Oklahoma-Kansas	36.0	37.7	40.5	42.4	46.3	49.0	50.0	50.6	50.4
Texas	25.3	23.7	26.5	30.8	33.9	36.9	39.0	39.7	39.6
Louisiana-Arkansas	25.0	23.5	24.6	24.2	21.5	24.3	27.0	28.6	32.3
Rocky Mountain	52.2	53.7	53.7	54.1	52.5	52.7	52.6	58.0	58.7
California	14.3	15.6	19.7	20.1	19.4	21.3	23.7	25.9	30.5
United States	27.1	28.8	30.0	31.2	32.4	34.9	36.0	37.4	39.4

Authority: Compiled from reports of U. S. Bureau of Mines.

PRODUCTION AND STOCKS OF GASOLINE BY REFINERY DISTRICTS
(Thousands of Barrels of 42 U. S. Gallons)

	1923	1924	1925	1926	1927	1928	1929
Production:							
East Coast	33,325	39,956	41,527	46,142	49,247	53,694	57,851
Appalachian	7,509	8,316	10,154	12,231	12,581	15,894	16,061
Indiana-Illinois, etc.	24,174	28,004	34,800	40,181	43,682	55,716	65,102
Oklahoma-Kansas, etc.	29,887	36,187	47,978	50,971	55,215	60,943	62,432
Texas	29,083	41,270	53,130	62,559	71,276	80,863	93,589
Louisiana-Arkansas	10,320	12,417	14,996	21,239	24,006	26,662	31,093
Rocky Mountain	15,053	15,230	14,563	16,350	14,313	16,497	16,431
California	30,552	31,946	42,453	50,061	60,115	66,676	91,682
U. S. Total	179,903	213,326	259,601	299,734	330,435	376,945	434,241
Texas Gulf Coast	21,914	30,480	39,694	48,748	56,412	62,526	71,003
Louisiana Gulf Coast	8,487	9,952	11,877	16,977	19,006	20,199	22,818
Stocks End of Period:							
East Coast	5,864	4,868	8,039	7,385	4,748	5,537	6,063
Appalachian	599	635	770	846	1,035	1,229	1,383
Indiana-Illinois, etc.	2,689	3,789	4,177	4,357	3,734	5,099	5,634
Oklahoma-Kansas, etc.	3,290	2,882	2,822	3,096	2,983	3,691	4,123
Texas	3,509	3,677	4,865	5,002	4,889	4,863	6,648
Louisiana-Arkansas	2,609	2,047	5,014	3,259	1,491	2,158	2,145
Rocky Mountain	2,466	2,758	3,911	4,137	1,643	1,568	2,334
California	6,988	10,167	9,277	10,941	12,793	8,921	14,785
U. S. Total	28,014	30,823	38,875	39,023	33,316	33,066	43,115
Texas Gulf Coast	3,273	3,247	4,280	4,569	4,197	4,063	5,313
Louisiana Gulf Coast	2,548	1,930	4,911	3,196	1,413	1,979	1,838

Authority: U. S. Bureau of Mines.

PRODUCTION AND STOCKS OF KEROSENE BY REFINERY DISTRICTS
(Thousands of Barrels of 42 U. S. Gallons)

	1923	1924	1925	1926	1927	1928	1929
Production:							
East Coast	13,478	13,743	13,665	12,331	10,413	8,563	8,091
Appalachian	3,606	3,495	3,407	4,211	3,836	3,719	3,671
Indiana-Illinois, etc.	5,164	5,703	6,131	4,937	5,260	6,318	5,334
Oklahoma-Kansas, etc.	6,679	8,123	9,090	8,901	9,123	10,239	10,052
Texas	12,757	13,310	13,360	15,806	13,892	14,494	13,336
Louisiana-Arkansas	6,073	6,190	5,461	6,673	6,129	5,814	5,501
Rocky Mountain	3,024	2,364	2,207	2,108	1,864	1,829	1,530
California	5,146	7,098	6,368	6,801	5,596	8,377	9,639
U. S. Total	55,927	60,026	59,689	61,768	56,113	59,353	57,154
Texas Gulf Coast	10,176	10,786	10,982	13,072	11,425	11,609	10,356
Louisiana Gulf Coast	5,268	5,317	4,789	6,097	5,452	5,182	4,829
Stocks End of Period:							
East Coast	1,735	1,692	1,275	1,664	1,401	1,288	1,340
Appalachian	312	304	232	245	316	312	293
Indiana-Illinois, etc.	936	855	857	778	1,004	1,286	943
Oklahoma-Kansas, etc.	419	765	381	677	605	729	1,002
Texas	1,371	2,349	1,969	2,066	1,322	1,565	1,582
Louisiana-Arkansas	1,092	878	307	1,129	937	946	749
Rocky Mountain	158	219	327	383	350	366	289
California	1,208	1,532	1,773	1,633	1,780	2,509	2,841
U. S. Total	7,231	8,594	7,121	8,575	7,715	9,001	9,039
Texas Gulf Coast	839	1,955	1,570	1,467	1,236	1,472	1,425
Louisiana Gulf Coast	1,065	850	301	1,116	911	927	694

Authority: U. S. Bureau of Mines.

PRODUCTION AND STOCKS OF GAS AND FUEL OIL BY REFINERY DISTRICTS

(Thousands of Barrels of 42 U. S. Gallons)

	1923	1924	1925	1926	1927	1928	1929
Production:							
East Coast	57,444	68,010	58,925	59,972	74,458	94,023	91,011
Appalachian	4,788	4,578	5,761	6,776	6,997	7,271	7,165
Indiana-Illinois, etc.	15,852	17,480	18,510	19,344	21,850	32,715	36,296
Oklahoma-Kansas, etc.	30,111	32,095	37,128	33,053	33,653	37,193	38,439
Texas	50,426	58,046	66,033	64,773	72,304	79,349	92,448
Louisiana-Arkansas	17,348	23,034	37,358	34,393	31,548	33,954	32,114
Rocky Mountain	13,910	12,540	11,208	8,160	7,348	7,100	6,950
California	97,602	104,693	130,068	138,724	144,908	135,632	143,471
U. S. Total	287,481	320,476	364,991	365,195	393,066	427,237	447,894
Texas Gulf Coast	39,284	43,015	48,610	49,074	55,277	56,227	62,244
Louisiana Gulf Coast	12,301	14,311	26,053	19,519	17,883	19,256	17,480
Stocks End of Period:							
East Coast	6,281	4,875	5,492	6,519	11,209	5,360	6,940
Appalachian	876	520	586	788	1,068	1,190	1,003
Indiana-Illinois, etc.	1,060	843	1,002	1,145	1,434	2,771	3,490
Oklahoma-Kansas, etc.	1,934	3,154	3,905	5,008	5,205	6,385	4,033
Texas	8,341	6,622	8,113	8,026	10,767	11,952	14,868
Louisiana-Arkansas	1,344	3,040	3,995	2,256	3,681	6,070	2,771
Rocky Mountain	684	502	1,588	1,156	658	1,198	1,320
California	15,552	20,218	*85,783	*87,270	*93,719	*98,919	*111,660
U. S. Total	36,072	39,774	110,464	112,168	127,741	133,845	146,085
Texas Gulf Coast	7,553	5,122	6,950	6,996	9,044	9,242	10,943
Louisiana Gulf Coast	1,215	2,666	3,169	1,590	3,120	5,033	1,892

*Includes heavy crude oil and all grades of fuel oil in California.

Authority: U. S. Bureau of Mines.

PRODUCTION AND STOCKS OF LUBRICANTS BY REFINERY DISTRICTS

(Thousands of Barrels of 42 U. S. Gallons)

	1923	1924	1925	1926	1927	1928	1929
Production:							
East Coast	7,476	8,064	9,189	9,567	10,144	10,817	10,874
Appalachian	3,988	4,265	4,511	4,799	4,410	5,109	5,243
Indiana-Illinois, etc.	2,526	2,514	3,207	3,268	3,309	3,943	3,901
Oklahoma-Kansas, etc.	1,956	2,220	2,518	2,480	2,365	2,639	2,678
Texas	6,808	6,666	7,716	8,043	7,849	8,361	7,727
Louisiana-Arkansas	611	761	793	832	741	769	968
Rocky Mountain	457	470	587	640	590	620	580
California	2,306	2,538	2,534	2,664	2,313	2,400	2,388
U. S. Total	26,128	27,498	31,055	32,293	31,721	34,658	34,359
Texas Gulf Coast	6,720	6,261	7,203	7,724	7,470	7,962	7,386
Louisiana Gulf Coast	597	680	734	811	737	739	822
Stocks End of Period:							
East Coast	2,383	2,151	2,687	2,599	2,629	2,773	2,757
Appalachian	728	815	844	993	1,095	1,220	1,175
Indiana-Illinois, etc.	647	606	793	647	840	805	854
Oklahoma-Kansas, etc.	234	394	444	423	512	480	514
Texas	1,212	1,376	1,387	1,773	1,671	1,899	1,732
Louisiana-Arkansas	83	161	108	119	114	103	116
Rocky Mountain	137	132	174	150	127	181	169
California	714	785	816	872	872	879	952
U. S. Total	6,138	6,420	7,253	7,576	7,860	8,340	8,269
Texas Gulf Coast	1,209	1,357	1,348	1,738	1,606	1,817	1,686
Louisiana Gulf Coast	78	145	107	119	113	101	110

Authority: U. S. Bureau of Mines.

Wax Production and Consumption

(Thousands of Pounds)

	Production	Imports	Exports	Stocks end of year	Domestic demand
1918	505,144	5,647	235,543	199,658	210,650
1919	467,235	9,883	263,345	222,462	190,969
1920	541,405	7,629	375,276	195,368	180,852
1921	433,887	4,546	225,881	207,563	200,357
1922	462,003	7,447	284,501	204,891	187,621
1923	466,647	12,843	329,793	164,758	189,830
1924	516,491	867	382,820	89,706	221,590
1925	590,577	14,588	334,179	116,391	244,301
1926	645,815	9,983	335,584	167,214	251,274
1927	584,347	20,462	340,423	*150,638	282,503
1928	630,144	24,741	392,705	110,344	302,474
1929	630,074	40,522	318,488	187,990	274,462

* New basis of figuring wax stock. This is 1927 figure and is comparable with 1928.

Authority: U. S. Bureau of Mines.

Asphalt Production from Petroleum

Year	Tons	Year	Tons
1918	607,968	1924	2,545,573
1919	901,885	1925	2,677,400
1920	1,290,614	1926	2,922,788
1921	1,214,536	1927	3,417,700
1922	1,895,257	1928	3,296,800
1923	2,327,116	1929	3,469,200

Authority: U. S. Bureau of Mines.

Petroleum Coke Production

Year	Tons	Year	Tons
1918	559,663	1924	761,095
1919	603,459	1925	991,000
1920	576,613	1926	995,308
1921	604,465	1927	1,145,200
1922	707,064	1928	1,426,600
1923	672,526	1929	1,806,600

Authority: U. S. Bureau of Mines.

GASOLINE FROM NATURAL GAS

An increasingly important source of gasoline is natural gas, which is supplementing the supply derived from crude petroleum. In 1928 the production of natural gasoline (according to the U. S. Bureau of Mines) amounted to 1,814,034,000 gallons, as compared with 282,536,000 gallons produced as recently as 1918.

The development of this source of supply ranks only second to "cracked" gasoline, derived from fuel oil and gas oil, in its importance in supplying the tremendous demands of the motorist. Commercial natural gasoline production dates from 1911. The gas from petroleum and natural gas wells is treated by two principal methods, absorption and compression. The raw gasoline derived is a very volatile product. New methods of rectification have been developed which now make it possible to produce natural gasoline suitable for use in high compression airplane motors, but the major portion of the natural gasoline produced is used for blending with petroleum gasoline of low volatility, thus making available for motor use a quantity of motor fuel in excess of natural production.

The utilization of natural gas for making gasoline constitutes one of the most important achievements of the industry toward conservation. Formerly most of the gas coming out of oil wells was permitted to escape into the air. In recent years the building of natural gasoline plants to take care of this gas has become an integral part of lease operations throughout the country.

Making gasoline from natural gas is an industry apart from the manufacture of gasoline from petroleum, although closely related.

Natural Gasoline Produced and Natural Gas Treated in the United States, by States

State	Number of operators reporting[1]	Number of plants	Raw (unblended) gasoline produced			Estimated quantity of natural gas treated	
			Thousands of gallons	Value at plant		Millions of cubic feet	Average yield per M cubic feet (gallons)
				Thousands of dollars	Average per gallon (cents)		
1927							
Alaska	1	1	19	2	10.5	15	1.3
Arkansas	12	16	37,498	2,281	6.1	20,566	1.8
California	50	152	498,020	52,436	10.5	332,676	1.5
Colorado	2	2	912	64	7.0	1,455	0.6
Illinois	27	83	8,853	532	6.0	3,582	2.5
Kansas	15	25	36,095	1,746	4.8	28,906	1.2
Kentucky	10	12	7,480	547	7.3	27,994	0.3
Louisiana	29	49	44,844	2,442	5.4	118,191	0.4
New Mexico	1	1	1,827	109	6.0	998	1.8
New York	3	3	449	38	8.5	539	0.8
Ohio	21	39	12,167	1,062	8.7	42,623	0.3
Oklahoma	98	302	548,109	29,114	5.3	262,703	2.1
Pennsylvania	98	147	16,744	1,648	9.8	47,424	0.4
Texas	57	152	320,723	18,347	5.7	265,699	1.2
West Virginia	44	125	64,192	5,421	8.4	152,297	0.4
Wyoming	8	10	43,212	2,899	6.7	35,580	1.2
	[1]394	1,119	1,641,144	118,688	7.2	1,341,248	1.2
1928							
Alaska	1	1	26	3	11.5	20	1.3
Arkansas	11	14	32,677	2,568	7.9	13,030	2.5
California	52	147	584,111	53,885	9.2	380,059	1.5
Colorado	2	2	1,909	136	7.1	3,498	0.5
Illinois	23	78	7,817	585	7.5	2,999	2.6
Kansas	14	25	36,765	2,444	6.6	33,091	1.1
Kentucky	10	12	7,267	575	7.9	25,801	0.3
Louisiana	27	49	55,022	3,434	6.2	129,513	0.4
New Mexico	1	1	1,506	107	7.1	731	2.1
New York	3	3	392	45	11.5	411	1.0
Ohio	16	35	13,174	1,146	8.7	49,572	0.3
Oklahoma	95	297	619,691	40,959	6.6	275,961	2.2
Pennsylvania	86	131	16,571	1,570	9.5	49,542	0.3
Texas	57	156	324,516	22,492	6.9	309,769	1.0
West Virginia	42	118	69,729	6,220	8.9	164,120	0.4
Wyoming	7	9	42,861	2,775	6.5	35,317	1.2
	[1]369	1,078	1,814,034	138,944	7.7	1,473,434	1.2

[1] A producer operating in more than 1 State is counted only once.

Authority: U. S. Bureau of Mines

NATURAL GASOLINE PRODUCED IN THE UNITED STATES, 1919-1928, BY STATES

(Thousands of Gallons)

Year	Arkansas	California	Colorado	Illinois	Kansas	Kentucky	Louisiana	New Mexico	New York
1919	.....	40,386	.....	6,060	3,284	5,136	10,063	.....	458
1920	.....	48,208	.....	6,055	4,331	4,497	10,610	.....	411
1921	.....	58,220	.....	7,536	3,587	4,242	15,341	.....	366
1922	4,289	67,120	.....	7,760	2,856	5,205	29,406	.....	506
1923	16,183	173,329	.....	7,356	8,775	7,601	40,720	.....	408
1924	17,533	232,579	.....	9,091	11,658	7,274	48,098	.....	477
1925	19,686	303,180	35	9,874	19,592	7,685	43,489	.....	414
1926	30,385	389,366	276	9,987	25,369	7,689	43,557	1,488	539
1927	37,498	498,020	912	8,853	36,095	7,480	44,844	1,827	449
1928	32,677	584,111	1,909	7,817	36,765	7,267	55,022	1,506	392

Year	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Alaska	Total		
								Thousands of gallons	Value at plant	
									Thousands of dollars	Average per gallon (cents)
1919	8,801	189,995	20,284	9,337	52,150	5,581	..	351,535	64,197	18.3
1920	10,016	178,857	21,151	32,956	58,941	8,711	..	384,744	71,788	18.7
1921	9,100	185,341	19,856	77,141	54,646	14,558	..	449,934	61,815	13.7
1922	8,600	189,404	18,518	95,405	56,796	19,967	..	505,832	72,711	14.4
1923	10,035	270,249	19,132	177,765	63,381	21,292	..	816,226	77,268	9.5
1924	9,443	301,062	19,254	186,571	61,549	29,272	..	933,861	82,233	8.8
1925	8,701	390,861	18,850	214,092	58,201	32,777	33	1,127,470	120,383	10.7
1926	10,817	475,716	20,343	243,093	63,807	40,625	33	1,363,090	136,412	10.0
1927	12,167	548,109	16,744	320,723	64,192	43,212	19	1,641,144	118,688	7.2
1928	13,174	619,691	16,571	324,516	69,729	42,861	26	1,814,034	138,944	7.7

Authority: U. S. Bureau of Mines

CAPACITY OF NATURAL GASOLINE PLANTS

There were 1,035 natural gasoline plants in the United States, with a total daily capacity of 10,516,000 gallons, on January 1, 1930, according to a survey conducted by the U. S. Bureau of Mines, Department of Commerce. The last similar survey, that of January 1, 1928, showed a total of 1,155 plants of 8,048,000 gallons daily capacity. Thus in two years' time the number of plants has decreased by 120, but the total capacity has increased 2,468,000 gallons, or 31 per cent. This is roughly equivalent to the gain in production over the same period.

Over half of the increase in total capacity was registered in California, where the development of flush oil production, having a comparatively high gas-oil ratio in such fields as

Santa Fe Springs, led to construction of some new plants and material enlargement of others.

Of the total plants, 999 were operating on January 1, 1930, and 36 were shut down. This compares with 1,060 operating and 95 shut down two years ago, which indicates a tendency to dismantle plants as soon as they become obsolete or unprofitable. The total daily capacity of the plants operating on January 1, 1930 amounted to 10,278,000 gallons, or 98 per cent of the total, leaving only 238,000 gallons, or 2 per cent, for the shut-down plants.

During 1929 the average total daily capacity of the operating plants was 9,899,000 gallons, while the average daily production amounted to 6,015,000 gallons. This indicates that the plants operated during 1929 at 61 per cent of their capacity.

The absorption method of extracting natural gasoline made a further gain in relative importance during 1928 and 1929 at the expense of the compression and charcoal methods. The daily capacity of the plants using the absorption method increased from 5,476,000 gallons on January 1, 1928 to 7,956,000 gallons on January 1, 1930, at which date it comprised 76 per cent of the total. The charcoal method of producing natural gasoline, the most recent development in natural gasoline manufacturing equipment, declined in favor during 1928 and 1929, when the total number of plants fell from 27 to 23, and the total daily capacity from 214,000 gallons to 186,000 gallons.

UTILIZATION OF PETROLEUM PRODUCTS

Probably no other raw material enters so many fields of utilization as petroleum.

Crude oil, subjected to a series of refining processes, in its initial distillation, releases the hydrocarbon gases. These are the source of fuel gas, used to heat refinery boilers; gas, or carbon, black, used in making rubber tires, inks, and paints; and a series of alcohols used in hospitals and homes and as solvents for lacquers, soaps, and essential oils. From natural gas, which in Nature is associated with crude oil, come liquefied gases; petroleum ether; natural gasoline; pentane; hexane, and numerous solvents.

The first products of distillation are the white distillates, or naphthas and refined oils. The naphthas yield aviation gasoline and motor gasoline, commercial solvents, blending naphtha, varnish-makers' and painters' naphtha, and dyers' and cleaners' benzine. The refined oils include kerosene, illuminating oil, stove oil, tractor oil, signal oil and mineral seal oil. Produced also at this stage of distillation is furnace oil, the oil-heater fuel.

The intermediate distillates are a source of gas oil and absorber oil. Gas oil is used by gas manufacturing plants in the carburetion of water gas, and is an important metallurgical fuel. Also it yields gasoline, by the " cracking " process, and Diesel fuel oil. Absorber oil enters into gasoline and benzol recovery.

From the heavy distillates next derived come technical heavy oils, waxes and lubricating oil. The white oils which lubricate bakers' and candymakers' machinery; the medicinal oils used alone and in salves, creams, and ointments; and ink, saturating, emulsifying, electrical and flotation oils are among products obtained from technical heavy oils. The waxes are used in making candles, chewing gum, and candy; enter the laundry as detergents and iron waxes; and find

wide use for sealing preserved fruits and vegetables. The lubricating oils are used wherever machinery is operated.

The residues of distillation are put to various uses. The greases are lubricants, and by refining yield petrolatum and petroleum jelly. Residual fuel oil is burned under the boilers of industrial plants, ships, and locomotives, and for making gasoline by " cracking " processes. Additional products of the residues are road oil, asphalts, pitches, and coke.

From refinery sludges are made acid coke, a fuel; sulfonic acid, a saponification and de-emulsifying agent; oils and pitches; and the sulfuric acid used in fertilizer manufacture.

UTILIZATION OF GASOLINE

ENORMOUS GROWTH IN GASOLINE USE

In 1919 there were 7,565,000 motor vehicles registered in this country. At the close of 1929 there were 26,501,000 cars. In 1919 81,783,000 barrels of gasoline supplied the country's gasoline requirements. In 1929 the domestic consumption of gasoline was 371,852,000 barrels.

The increase in motor vehicles and gasoline consumption is shown in the following table:

Year	Number of automobiles registered at end of year	Domestic consumption of gasoline barrels
1919	7,565,446	81,783,000
1920	9,231,941	101,208,000
1921	10,464,715	107,525,000
1922	12,239,853	127,906,000
1923	15,092,177	159,167,000
1924	17,595,373	185,003,000
1925	19,954,347	223,863,000
1926	22,001,393	261,813,000
1927	23,133,243	296,808,000
1928	24,493,124	328,489,000
1929	26,501,443	371,852,000

GASOLINE CONSUMPTION BY STATES

In 1929 all states were levying gasoline taxes, and annual gasoline motor consumption figures were available for all states except New York and Illinois. Taxes in these two states went into effect during 1929.

Motor Gasoline Consumption by States *

(Thousands of Gallons)

States	1929	1928
Alabama	178,162,000	168,276,000
Arizona	72,862,000	57,316,000
Arkansas	134,606,000	119,184,000
California	1,253,337,000	1,101,404,000
Colorado	155,508,000	142,015,000
Connecticut	202,355,000	182,307,000
Delaware	32,576,000	27,706,000
District of Columbia	71,884,000	63,579,000
Florida	223,809,000	224,704,000
Georgia	220,602,000	206,138,000
Idaho	55,125,000	50,148,000
Indiana	432,095,000	388,466,000
Iowa	335,629,000	306,651,000
Kansas	360,928,000	315,671,000
Kentucky	154,816,000	134,836,000
Louisiana	176,770,000	169,046,000
Maine	96,036,000	82,203,000
Maryland	163,309,000	143,358,000
Massachusetts	501,909,000	.....
Michigan	785,269,000	673,335,000
Minnesota	357,904,000	328,434,000
Mississippi	141,451,000	129,157,000
Missouri	392,957,000	355,001,000
Montana	79,167,000	74,272,000
Nebraska	224,894,000	198,450,000
Nevada	17,813,000	14,378,000
New Hampshire	58,323,000	48,235,000
New Jersey	498,064,000	422,348,000
New Mexico	45,799,000	36,793,000
North Carolina	265,112,000	246,087,000
North Dakota	124,383,000	117,169,000
Ohio	953,552,000	860,631,000
Oklahoma	316,302,000	280,781,000
Oregon	163,672,000	144,283,000
Pennsylvania	900,496,000	759,027,000
Rhode Island	77,827,000	65,872,000
South Carolina	118,596,000	109,938,000
South Dakota	123,931,000	110,652,000
Tennessee	195,036,000	171,276,000
Texas	769,608,000	670,817,000
Utah	56,547,000	47,634,000
Vermont	43,992,000	37,312,000
Virginia	208,304,000	183,447,000
Washington	253,457,000	227,043,000
West Virginia	126,539,000	111,345,000
Wisconsin	393,396,000	357,146,000
Wyoming	34,547,000	31,794,000
Total	12,549,256,000	10,695,665,000

* Figures based on gasoline consumed by motor vehicles and other taxable consumption. In a few instances small quantities of non-taxable gasoline are included.

Authority: American Petroleum Institute from records of states having gasoline tax or inspection laws.

AUTOMOTIVE EXPANSION

The number of motor vehicles registered in the United States at the end of 1929 (according to the Bureau of Public Roads, U. S. Department of Commerce) was 26,501,443. This includes passenger cars and motor trucks. The expansion of the automotive industry, and the development of the use of motor vehicles, as tending to affect the use of gasoline, are shown in the following figures presented in "Facts and Figures of the Automobile Industry," 1930 edition, published by the National Automobile Chamber of Commerce.

MOTOR VEHICLE REGISTRATIONS

December 31	Passenger cars		Motor trucks		Total motor vehicles	
	Number	Per cent increase	Number	Per cent increase	Number	Per cent increase
1895	4	....	.....	....	4	....
1896	16	....	.....	....	16	....
1897	90	....	.....	....	90	....
1898	800	....	.....	....	800	....
1899	3,200	....	.....	....	3,200	....
1900	8,000	....	.....	....	8,000	....
1901	14,800	85%	.....	....	14,800	85%
1902	23,000	55%	.....	....	23,000	55%
1903	32,920	43%	.....	....	32,920	43%
1904	54,590	66%	410	....	55,000	67%
1905	77,400	42%	600	46%	78,000	42%
1906	105,900	37%	1,100	83%	107,000	37%
1907	140,300	33%	1,700	55%	142,000	33%
1908	194,400	38%	3,100	82%	197,500	39%
1909	305,950	57%	6,050	95%	312,000	58%
1910	458,500	50%	10,000	65%	468,500	50%
1911	619,500	35%	20,000	100%	639,500	36%
1912	902,600	46%	41,400	107%	944,000	48%
1913	1,194,262	32%	63,800	54%	1,258,062	33%
1914	1,625,739	36%	85,600	34%	1,711,339	36%
1915	2,309,666	42%	136,000	59%	2,445,666	43%
1916	3,297,996	43%	215,000	58%	3,512,996	44%
1917	4,657,340	42%	326,000	52%	4,983,340	42%
1918	5,621,617	21%	525,000	61%	6,146,617	23%
1919	6,771,074	21%	794,372	51%	7,565,446	23%
1920	8,225,859	22%	1,006,082	27%	9,231,941	22%
1921	9,346,195	14%	1,118,520	18%	10,464,715	13%
1922	10,864,128	16%	1,375,725	16%	12,239,853	17%
1923	13,479,608	24%	1,612,569	17%	15,092,177	23%
1924	15,460,649	15%	2,134,724	32%	17,595,373	17%
1925	17,512,638	13%	2,441,709	15%	19,954,347	14%
1926	19,237,171	10%	2,764,222	13%	22,001,393	10%
1927	20,219,224	5%	2,914,019	5%	23,133,243	5%
1928	21,379,125	6%	3,113,999	7%	24,493,124	6%
1929	23,121,589	8%	3,379,854	8%	26,501,443	8%

Authortiy: Bureau of Public Roads, U. S. Department of Agriculture.

PRODUCTION AND WHOLESALE VALUE OF MOTOR VEHICLES

	Passenger cars		Motor trucks		Total cars and trucks	
	Number	Value	Number	Value	Number	Value
1900.....	4,192	$4,899,443	.....	.....	4,192	$4,899,443
1901.....	7,000	8,183,000	.....	.....	7,000	8,183,000
1902.....	9,000	10,395,000	.....	.....	9,000	10,395,000
1903.....	11,235	13,000,000	.....	.....	11,235	13,000,000
*1904.....	22,419	23,682,492	411	$946,947	22,830	24,629,439
1905.....	24,550	39,030,000	450	970,000	25,000	40,000,000
1906.....	33,500	61,850,000	500	1,050,000	34,000	62,900,000
1907.....	43,300	92,040,000	700	1,360,000	44,000	93,400,000
1908.....	63,500	135,250,000	1,500	2,550,000	65,000	137,800,000
*1909.....	127,731	159,918,506	3,255	5,230,023	130,986	165,148,529
1910.....	181,000	215,340,000	6,000	9,660,000	187,000	225,000,000
1911.....	199,319	225,000,000	10,681	21,000,000	210,000	246,000,000
1912.....	356,000	335,000,000	22,000	43,000,000	378,000	378,000,000
1913.....	461,500	399,902,000	23,500	44,000,000	485,000	443,902,000
*1914.....	543,679	413,859,379	25,375	45,098,464	569,054	458,957,843
1915.....	895,930	575,978,000	74,000	125,800,000	969,930	701,778,000
1916.....	1,525,578	921,378,000	92,130	161,000,000	1,617,708	1,082,378,000
1917.....	1,745,792	1,053,505,781	128,157	220,982,668	1,873,949	1,274,488,449
1918.....	943,436	801,937,925	227,250	434,168,992	1,170,686	1,236,106,917
1919.....	1,657,652	1,461,785,925	275,943	423,326,621	1,933,595	1,885,112,546
1920.....	1,905,560	1,809,170,963	321,789	423,249,410	2,227,349	2,232,420,373
†1921.....	1,518,061	1,091,752,452	164,304	169,914,098	1,682,365	1,261,666,550
†1922.....	2,369,089	1,561,740,645	277,140	231,282,063	2,646,229	1,793,022,708
†1923.....	3,753,945	2,274,554,488	426,505	317,478,940	4,180,450	2,592,033,428
†1924.....	3,303,646	2,040,706,519	434,140	326,706,496	3,737,786	2,367,413,015
†1925.....	3,870,744	2,544,528,799	557,056	470,634,763	4,427,800	3,015,163,562
†1926.....	3,948,843	2,746,064,722	556,818	468,752,769	4,505,661	3,214,817,491
†1927.....	3,083,360	2,265,633,102	497,020	435,072,641	3,580,380	2,700,705,743
†1928.....	4,012,158	2,703,753,500	588,983	459,045,380	4,601,141	3,162,798,880
†1929.....	4,794,898	2,981,141,842	826,811	595,504,039	5,621,709	3,576,645,881

* From United States Census reports. 1900 for fiscal year ended June 30, 1900.
† Figures include production of plants located in Canada.

Authority: National Automobile Chamber of Commerce

TOTAL MOTOR VEHICLE REGISTRATIONS BY STATES—1924–1929

STATE	1924	1925	1926	1927	1928	1929
Alabama	157,262	194,580	225,930	243,539	269,519	285,533
Arizona	57,828	68,029	73,682	81,047	94,372	109,013
Arkansas	141,983	183,589	209,419	206,568	214,931	233,128
California	1,319,394	1,440,541	1,600,475	1,693,195	1,799,890	1,974,341
Colorado	213,247	240,097	248,613	268,492	284,867	303,489
Connecticut	217,236	250,669	263,235	281,521	309,792	328,063
Delaware	35,136	40,140	44,834	47,124	51,210	54,960
District of Columbia	88,762	103,092	111,497	111,680	126,556	151,450
Florida	195,128	286,388	401,562	394,734	352,961	345,977
Georgia	207,688	248,093	277,468	300,635	318,856	358,905
Idaho	69,227	81,506	94,760	101,336	108,154	118,074
Illinois	1,119,236	1,263,177	1,370,503	1,438,985	1,504,359	1,615,088
Indiana	651,705	725,410	772,326	813,637	823,806	866,715
Iowa	616,128	659,202	698,998	704,203	733,466	784,450
Kansas	410,891	457,033	491,276	501,901	533,799	581,223
Kentucky	229,804	261,647	281,557	285,621	304,231	332,848
Louisiana	178,000	207,000	239,500	255,000	264,293	280,868
Maine	127,598	140,499	151,486	163,623	172,638	184,506
Maryland	198,465	234,247	252,852	276,863	285,311	319,873
Massachusetts	570,578	646,153	690,190	694,107	726,295	817,704
Michigan	867,545	989,010	1,118,785	1,154,773	1,249,221	1,395,102
Minnesota	503,437	569,694	630,285	646,682	673,573	730,399
Mississippi	134,680	177,262	205,200	218,043	246,242	250,011
Missouri	540,500	604,166	654,554	682,419	712,965	756,680
Montana	79,695	94,656	103,958	112,735	126,035	140,387
Nebraska	308,715	338,719	366,773	373,912	391,355	418,226
Nevada	18,118	21,169	24,014	25,776	27,376	31,915
New Hampshire	71,149	81,498	89,001	96,009	102,644	108,880
New Jersey	504,470	580,554	651,415	712,396	758,430	832,332
New Mexico	41,680	49,111	54,996	59,291	65,737	78,374
New York	1,412,879	1,625,583	1,815,434	1,937,918	2,083,942	2,263,259
North Carolina	302,232	340,287	385,047	430,499	464,376	483,602
North Dakota	117,346	144,972	157,822	160,701	173,525	188,046
Ohio	1,241,600	1,346,400	1,480,246	1,570,734	1,649,699	1,766,614
Oklahoma	369,903	424,345	499,938	503,126	529,843	570,791
Oregon	192,615	216,553	233,568	244,572	248,118	269,007
Pennsylvania	1,228,845	1,330,433	1,455,184	1,554,915	1,642,207	1,733,283
Rhode Island	95,482	101,756	110,746	118,014	125,698	134,009
South Carolina	161,753	168,496	181,189	199,635	216,805	231,274
South Dakota	142,396	168,028	168,230	169,552	191,374	204,199
Tennessee	204,680	244,626	279,639	294,567	322,137	362,431
Texas	801,833	975,083	1,049,869	1,111,407	1,214,297	1,348,107
Utah	68,316	90,500	85,380	93,974	98,541	112,661
Vermont	61,179	69,576	74,063	79,527	86,231	93,030
Virginia	261,945	282,650	322,614	337,607	360,545	387,205
Washington	295,443	328,442	363,279	384,583	402,875	442,341
West Virginia	191,085	217,589	227,836	245,819	251,556	268,888
Wisconsin	525,221	594,386	662,282	698,289	742,135	793,502
Wyoming	43,639	47,711	49,883	51,955	56,336	60,680
Totals	17,593,677	19,954,347	22,001,393	23,133,241	24,493,124	26,501,443

Authority: Bureau of Public Roads, U. S. Department of Agriculture

INCREASE IN PASSENGER CARS

Over a period of eleven years the use of automotive passenger cars has increased 226 per cent.

REGISTRATION OF PASSENGER CARS IN UNITED STATES

Year	Number	Year	Number
1919	6,771,074	1924	15,460,649
1920	8,225,859	1925	17,512,638
1921	9,346,195	1926	19,237,171
1922	10,864,128	1927	20,230,429
1923	13,479,608	1928	21,379,125
		1929	23,121,589

YEAR-ROUND OPERATION OF PASSENGER CARS

During recent years there has been a notable demand for closed passenger cars, making possible all-year-round operation and thus, in turn, increasing gasoline demand per motor car. In 1919 only 10.3 per cent of the cars produced were closed cars. Each year since, the proportion of closed cars manufactured has increased until, in 1929, it amounted to 89.4 per cent of the total.

PER CENT OPEN AND CLOSED CARS BY YEARS

(U. S. and Canada)

	Open	Closed	Per cent closed		Open	Closed	Per cent closed
1919*	1,496,652	161,000	10.3	1924	1,883,280	1,420,366	43.0
1920*	1,581,610	323,950	17.0	1925	1,684,106	2,186,638	56.5
1921	1,182,576	335,485	22.1	1926	1,105,505	2,843,338	72.0
1922	1,654,909	714,180	30.0	1927	466,238	2,617,122	84.9
1923	2,477,635	1,276,310	34.0	1928	460,128	3,552,030	88.5
				1929	510,409	4,284,489	89.4

* United States only.

INCREASE IN MOTOR TRUCKS

Over a period of eleven years, the use of motor trucks has increased nearly 325 per cent.

REGISTRATION OF MOTOR TRUCKS

Year	Number	Year	Number
1919	794,372	1924	2,133,028
1920	1,006,082	1925	2,441,709
1921	1,118,520	1926	2,764,222
1922	1,375,725	1927	2,896,886
1923	1,612,569	1928	3,113,999
		1929	3,379,854

Railway Age estimates that 55 railroads, with 5,900 trucks, now are making regular use of motor trucks for freight and other service. This does not include 9,759 trucks of the Railway Express Agency, which are owned by steam railways jointly.

MOTOR BUSES IN UNITED STATES

(Figures as of January 1)

	1926	1927	1928	1929	1930
Revenue					
1. City	....	....	....	....	12,750
2. Inter-city	....	....	....	....	26,850
Total intrastate (1 + 2)	36,000	39,306	41,286	42,750	39,600
3. Interstate	1,500	2,500	3,200	3,750	6,000
Total common carriers (1 + 2 + 3)	37,500	41,806	44,486	46,500	45,600
4. Sightseeing	2,500	2,650	2,750	2,750	2,750
Total (1 + 2 + 3 + 4)	40,000	44,456	47,236	49,250	48,350
Non-revenue					
5. Schools *	27,000	32,800	35,900	40,875	42,000
6. Hotel	1,000	1,050	1,000	800	750
7. Industrial	1,075	1,100	1,100	1,000	1,000
8. Miscellaneous	350	400	400	400	400
Total (5 + 6 + 7 + 8)	29,425	35,350	38,400	43,075	44,150
Grand total	69,425	79,806	85,636	92,325	92,500
a. Motor carriers	34,475	36,650	37,750	37,932	35,640
b. Electric railways	5,150	7,284	8,492	10,062	11,256
c. Steam railroads	375	522	994	1,256	1,454

* 3,000 or more buses in school service are operated part time as common carriers, and consequently are included in the figure for that service.

Authority: *Bus Transportation.*

Total Highway Mileage by States, 1928

	Total rural road mileage			Miles surfaced roads		
	Total	State highways	Local roads	Total	State highways	Local roads
Alabama	66,594	5,590	61,004	17,370	2,740	14,630
Arizona	21,849	2,213	19,636	3,421	1,586	1,835
Arkansas	74,757	8,718	66,039	6,779	4,916	1,863
California	79,604	6,572	73,032	25,080	3,927	21,153
Colorado	68,305	9,120	59,185	6,952	4,155	2,797
Connecticut	14,035	2,013	12,022	3,450	1,906	1,544
Delaware	3,797	703	3,094	1,094	703	391
Florida	29,740	6,414	23,326	14,018	3,234	10,784
Georgia	99,537	6,253	93,284	13,972	3,776	10,196
Idaho	39,093	4,259	34,834	8,487	2,372	6,115
Illinois	97,619	9,889	87,730	20,032	6,252	13,780
Indiana	73,609	4,610	68,999	50,995	4,592	46,403
Iowa	103,707	7,184	96,523	15,191	5,171	10,020
Kansas	132,245	8,691	123,554	4,585	2,729	1,856
Kentucky	61,261	11,500	49,761	16,130	5,137	10,993
Louisiana	35,493	9,053	26,440	10,731	6,287	4,444
Maine	21,002	1,911	19,091	5,293	1,681	3,612
Maryland	14,735	2,656	12,079	5,493	2,656	2,837
Massachusetts	18,941	1,587	17,354	8,783	1,579	7,204
Michigan	81,015	7,613	73,402	24,167	6,770	17,397
Minnesota	110,447	6,947	103,500	34,223	6,616	27,607
Mississippi	57,672	6,939	50,733	14,149	4,536	9,613
Missouri	110,592	7,527	103,065	12,319	4,268	8,051
Montana	66,931	8,007	58,924	3,178	1,354	1,824
Nebraska	93,912	8,012	85,900	4,651	3,877	774
Nevada	23,042	3,554	19,488	2,011	1,431	580
New Hampshire	12,028	2,365	9,663	2,546	2,164	382
New Jersey	17,022	1,821	15,201	8,734	1,681	7,053
New Mexico	48,332	9,354	38,978	2,361	2,010	351
New York	80,107	13,917	66,190	31,113	10,561	20,552
North Carolina	71,529	7,137	64,392	28,345	6,390	21,955
North Dakota	106,839	7,205	99,634	2,953	2,245	708
Ohio	84,999	10,953	74,046	46,245	10,497	35,748
Oklahoma	120,627	6,142	114,485	3,711	1,995	1,716
Oregon	51,633	4,368	47,265	11,995	3,490	8,505
Pennsylvania	90,696	13,330	77,366	24,901	9,166	15,735
Rhode Island	2,599	920	1,679	990	512	478
South Carolina	57,093	5,810	51,283	16,648	4,657	11,991
South Dakota	120,274	5,975	114,299	4,840	3,413	1,427
Tennessee	65,063	5,870	59,193	13,538	4,534	9,004
Texas	188,564	18,728	169,836	25,215	10,749	14,466
Utah	23,437	3,458	19,979	3,996	1,643	2,353
Vermont	15,041	4,204	10,837	4,857	3,384	1,473
Virginia	59,698	6,932	52,766	11,897	4,722	7,175
Washington	43,895	3,262	40,633	16,406	2,734	13,672
West Virginia	34,799	3,820	30,979	3,917	2,392	1,525
Wisconsin	81,289	10,221	71,068	26,771	8,642	18,129
Wyoming	41,183	3,115	38,068	1,604	1,306	298
Total, U. S.	3,016,281	306,442	2,709,839	626,137	193,138	432,999
Estimated total, 1929.	3,016,281	315,000	2,701,281	660,000	210,000	450,000

Authorities: U. S. Bureau of Public Roads and National Automobile Chamber of Commerce.

U. S. Exports of Motor Vehicles to Continents

Continent	1929		1928		1927	
	Cars	Trucks	Cars	Trucks	Cars	Trucks
Europe	88,129	63,184	110,858	41,236	79,880	25,479
North America ...	76,965	16,659	69,663	14,525	51,946	10,698
South America ..	76,893	49,008	78,540	36,132	58,292	26,314
Asia	36,805	27,960	35,152	18,978	21,290	10,175
Oceania	41,426	30,370	53,569	20,331	51,351	26,182
Africa	27,750	11,033	27,646	9,132	23,329	8,183
Total	347,968	198,234	375,428	140,334	286,088	107,031

Motor vehicles shipped as "parts for assembly" have not been included in the above table. Totals of these are as follows: 1926, passenger cars 48,676, trucks 30,600; 1927, cars 45,948, trucks 27,317; 1928, cars 43,472, trucks 23,497; 1929, cars 103,127, trucks 84,487.

Authority: U. S. Bureau of Foreign and Domestic Commerce.

GROWTH OF AVIATION

REFLECTING THE TRENDS IN AVIATION *

While aviation experienced the most stupendous period of progress and expansion in its history during 1929, the industry was passing through its first major readjustment when the year ended.

Man flew faster, higher, farther, and longer in 1929 than he did during any other year since the Wright brothers made their first flights. The year's spectacular flights and the routine maintenance of daily air transport schedules into every corner of the country reflect the great strides made in the field of engineering. The laboratories, occupied by engineers who seldom found a place in the limelight afforded those who flew their products, continued to offer the greatest prospects for future successes.

In the transport field, new mail, express, and passenger services were inaugurated to offer a network of air lines regularly serving 90,000,000 people. Air transport passen-

* From the Aircraft Year Book for 1930, compiled by Aeronautical Chamber of Commerce of America, Inc.

ger services were raised to the standard of luxury enjoyed by those who travel in the fine salons of fast ocean liners or the well appointed cars of the better trains. Expansion in the transport field, aided in no small way by contract air mail support, proved a great stimulus to every branch of the manufacturing industry.

The aircraft industry represented a total public investment of no less than half a billion dollars during 1929. Compared with those great industries which have an annual output in excess of this investment, aviation would appear to be relatively minor. Judged, however, from the triple viewpoint of national defense, public service, and scientific progress, aviation ranked as a major industry. It employed, directly or indirectly, more than 100,000 persons, and its ramifications extended into nearly three score allied industries which were affected in some way.

The story of aviation's progress has been marked by a succession of waves of expansion, each receding after peak marks were reached, only to have a new crest mount higher than ever before. The World War was responsible for the first great wave of expansion, when the industry was created, and plants were pressed into heavy production schedules through abnormal government demands for fighting planes.

The end of the war brought a sharp recession, which was checked only after far-visioned manufacturers, who had confidence in the possibilities of commercial aviation, marshalled a small amount of capital to support the industry. But their investments were swallowed up in general education, and the industry again found itself in the trough of the wave.

Government development of regular service for mail and goods in 1920 brought a new wave of development which demonstrated the possibilities of aviation, but emphasized the necessity for day and night operations if the airplane was to become an economic necessity.

Inauguration of the night air mail in 1924 pushed the wave to new heights. This was followed quickly by the es-

tablishment of contract air mail. Private operation of air mail lines was found to be arduous, however, owing to the continued necessity for public education. Again there came an indicated lull, and it was at this time that a pilot on the St. Louis-Chicago air mail route—Colonel Lindbergh—flew to fame in a night and carried with him the imagination of the world. Thus, wave was succeeded by wave, but always the trough of the last was higher than the peak of its predecessor. The latest and greatest was started in 1927, and continued through 1929, aided by the sustained interest of the Post Office Department, the application of the Five Year Military Program, and continually growing public confidence.

Using the immediate past as an index of the immediate future, and buoyed up by generally voiced prosperity current on all sides early in 1929, production of aircraft and engines during the first six months of the year approximated 75 per cent of the total production in 1928. The result was a general period of overproduction, which would be serious in any industry, but which was especially critical in an industry so closely related to national defense.

From the middle of the year on, production schedules were readjusted, so that by the end of the year the output of commercial airplanes and engines was relatively in line with the domestic demand, to which was being added an attractive export market.

Commercial aviation on an unstable foundation offers no substitution, or even a dependable reserve, for the nation's air defense. It became evident in 1929 that a sound foundation could be constructed only through maintenance of government orders, as typified in the Five Year Military Program, and through the continued development of the contract air mail system upon an economic basis.

Capital invested by the public flowed impartially into the manufacturing and operating branches of the industry. The manufacturers of military and commercial aircraft and the operators of air mail and passenger routes alike drew their capital from public sources. Military manufacturing

	1929	1928	1927	1926
AIR TRANSPORT				
Airplane miles flown, all operators	[1]22,000,000	10,673,450	5,870,489	4,318,087
Airplane miles flown daily, average for the year	[1]60,273	29,242	16,083	11,830
Passengers carried	[1]150,000	49,713	8,679	5,782
Express and freight carried, lb.	[1]2,000,000	1,848,156	2,263,580	1,733,090
Airplane miles flown with mail[2]	[1]16,000,000	7,846,296	[3]5,543,578	[3]4,240,407
Total mail carried[2], lb.	[1]7,700,000	4,063,173	[4]1,654,165	[4]810,855
Mail carried by contract[2], do.	[1]7,700,000	4,063,173	1,270,299	377,206
Mail income to contractors[2]	[1]$17,000,000	$7,432,721	[4]$2,643,454	[4]$765,549
Miles of mail airways, Dec. 31[2]	26,597	14,561	7,832	8,039
Average mail income per scheduled round trip[5]	.....	$994	$654	$295
Average mail load in pounds per scheduled round trip[5]	.....	489	273	112
Average income per pound of contract mail[5]	$2.01	$2.03	$2.08	$2.03
Average mail income per contract mile flown	.....	$0.94	$0.625	$0.39
Miles of all airways in operation, Dec. 31	36,000	16,667	9,122	8,404
Airways in operation, Dec. 31, number	65	47	22	[6]18
Lines in operation, Dec. 31, do.	97	63	23	[6]18
Mail operators, Dec. 31, do.	22	21	16	[6]15
Passenger operators, Dec. 31, do.	31	30	14	6
All operators, Dec. 31, number	35	37	19	[6]18
Total revenues, all operators	.....	[8]$8,349,817	[7]$2,643,454	[7]$765,549
Average passenger-mile rate	$0.12	$0.11	$0.106	$0.12
Airplanes in service and reserve, number	[1]525	325	128	.....
Value of above	[1]$12,000,000	[1]$7,000,000	[9]$1,838,462	.....
Pilots employed, number	[1]500	[10]308	107	.....
Total personnel employed	[1]2,000	[11]1,496	462	.....
Passenger and express income	.....	[12]$599,059	.....	.....
MISCELLANEOUS				
Airplane miles flown	[13]125,000,000	[13]60,0000,000	[13]30,000,000	[13]18,746,640
Miles lighted airways, Dec. 31	12,448	6,988	4,468	2,041
Under construction	1,352	2,314	1,277	1,108
Electric and gas beacons, Dec. 31	1,311	1,188	760	612
Lighted intermediate fields, Dec. 31, number	285	210	134	92
Radiobeacon stations, Dec. 31, do.	9	2	.....	.....
Radio communication stations, Dec. 31, do.	34	29	19	17
Weather Bureau regular stations, Dec. 31	207	206	207	202
Weather Bureau airways stations, Dec. 31	200	95	23	12
Private light beacons, Dec. 31	114	54	8	.....
Pilots licensed or pending, number	10,215	5,605	3,242	.....
Student permits, issued or pending, do.	20,400	10,528	545	.....
Approved models of airplanes, do.	279	96	21	.....
Approved models of engines, do.	35	13	.....	.....
Airplanes licensed, do.	6,685	4,156	2,299	.....
Airplanes dentified, do.	3,155	2,164	851	.....
States with regulatory legislation	20	18	13	7
States with "uniform state law" only	19	10	10	9
States with miscellaneous legislation	1	3	3	3
States with no legislation	8	17	22	29
Municipal airports, Dec. 31	453	368	240	.....
Private and commercial airports, Dec. 31	495	365	263	.....
Navy airports, including Marine Corps, Dec. 31	14	17	17	.....
Army, National Guard, and reserve airports, Dec. 31	68	64	62	.....
Marked auxiliary fields, Dec. 31	235	340	320	.....
Proposed airports, Dec. 31	1,413	921	422	.....
Production of airplanes, number	[1]6,200	4,346	1,995	1,186
Value of airplanes	[1]$75,000,000	$43,812,318	$14,504,999	$8,871,027
Total value of all air products	[1]$100,000,000	$64,662,491	$21,161,853	$17,694,905
Exported airplanes	354	162	63	50
Exports (airplanes, engines, and parts)	$9,202,385	$3,664,723	$1,903,583	$1,027,210
Concerns engaged in air industry, number	[1]1,500	1,400	900	600
Government consumption, airplanes (Army, etc.), number	[1]700	857	621	532

[1] Estimate.
[2] All air-mail routes, whether domestic or foreign.
[3] Includes all mail routes, whether government or contract.
[4] San Francisco-Chicago operated by post office until June 30, 1927; Chicago-New York, by post office until Aug. 31, 1927. All subsequent mail carried by contract.
[5] Domestic only, as foreign mail is carried on a mileage basis.
[6] Includes post office.
[7] Mail income only. No data on passenger and express income.
[8] Includes all reports on mail revenue, also passenger and express revenue from all but 5 operators.
[9] Reports from 20 of the 22 operators.
[10] Reports from 33 of 35 operators.
[11] Reports from 27 to 33 of the 35 operators.
[12] Reports from 21 of 35 operators.
[13] Estimate based on reports.

Authority: Aeronautics Branch, U. S. Department of Commerce.

and contract air mail proved the backbone of the industry—a condition which it was expected would be necessary for some time. Their satisfactory continuation was not only of great concern to the investing public, but of prime importance to the industry in its efforts to keep engineering and production organizations intact for purposes of civil and military development in the future and for the rapid expansion of manufacturing facilities in times of national emergency.

In its state of over expansion and overproduction toward the middle of 1929, the aircraft industry was scarcely different from any other industry. Capital inflation came in two forms: first, isolated and distinctly limited amounts invested in manufacturing or operating projects; and, second, massed capital by financial groups extending their activities into all phases of aviation.

At the end of the year, the industry was contracting in some phases and expanding in others. Isolated capital was in some instances liquidating. Group capital was wisely economizing and boldly advancing, willing to risk a long period of attrition, provided it had definite assurance of public support for the transport lines, government backing for the contract air mail system, and an assurance that the Five Year Military Program would be carried out.

The trend from corporate ownership to group control of manufacturing and operating units, started late in 1928, continued during 1929, and had a marked influence on the progress of the industry. At the close of the year, the major groups had a sound economic footing in the industry, which promised to affect, in no small way, future expansion. Using the past as an index of the future, leaders in the industry expected the next wave of expansion, based on sound experience, to surpass its predecessors in size and importance. It was this confidence in the future which inspired the major financial groups in the industry to proceed with their programs, taking into consideration proper regard for economy.

GASOLINE AND OIL CONSUMPTION BY AIRCRAFT ENGINES

Gasoline consumed by aircraft engines in civil and commercial aeronautical operations in the four-year period, 1926-1929, is estimated at 38,811,954 gallons by the Aeronautics Branch, U. S. Department of Commerce. The amount of engine lubricating oil consumed was estimated at 1,941,098 gallons.

Of the total estimated consumption of gasoline, 20,576,468 gallons, or more than half, were used by owners and operators of aircraft in the calendar year 1929. There also was a marked increase in the number of gallons of lubricating oil consumed in 1929 over the previous years, the estimate showing that of the total consumption for the four-year period, 1,028,823 gallons were used in 1929.

Miscellaneous aircraft operations—student instruction, aerial photography, private flying, sight-seeing, non-scheduled commercial operations, crop dusting and experimental flying—were responsible for an estimated consumption of 16,176,468 gallons of gasoline and 808,823 gallons of oil in 1929.

Scheduled air-transport operations of mail, passengers, and express used an estimated amount of 4,400,000 gallons of gasoline and 220,000 gallons of oil.

The growth of gasoline and oil consumption by aircraft engines in the four-year period for all operations—miscellaneous and scheduled—is shown in the following estimates:

Gasoline—Approximately 3,300,000 gallons in 1926, 5,060,000 in 1927, 9,900,000 in 1928, and 20,576,468 in 1929.

Engine oil—Approximately 165,000 gallons in 1926, 253,000 in 1927, 495,000 in 1928, and 1,028,823 in 1929.

Detailed estimates follow:

Estimated Gasoline and Oil Consumption by Commercial Aircraft

Air Transport

	1929	1928	1927	1926
Airplane-miles flown	[1] 22,000,000	10,673,450	5,870,489	4,318,087
Gasoline consumption ..gallons..	[1] 4,400,000	[1] 2,134,690	[1] 1,174,098	[1] 863,617
Oil consumption .....do.....	[1] 220,000	[1] 106,735	[1] 58,705	[1] 43,181

Miscellaneous

	1929	1928	1927	1926
Airplane-miles flown	[1] 125,000,000	[1] 60,000,000	[1] 30,000,000	[1] 18,746,640
Gasoline consumption ..gallons..	[2] 16,176,468	[2] 7,764,702	[2] 3,882,351	[2] 2,426,028
Oil consumption .....do.....	[2] 808,823	[2] 388,235	[2] 194,118	[2] 121,301

All Operations

Airplane-miles flown	[1] 147,000,000	[1] 70,673,450	[1] 35,870,489	[1] 23,064,727
Gasoline consumption ..gallons..	[1] 20,576,468	[1] 9,899,392	[1] 5,056,449	[1] 3,289,645
Oil consumption .....do.....	[1] 1,028,823	[1] 494,970	[1] 252,823	[1] 164,482

[1] Estimate based on reports.
[2] Estimate.

Authority: Aeronautics Branch, U. S. Department of Commerce.

UTILIZATION OF OIL FOR HEAT

An analysis of the progress of heating with oil, prepared by the American Oil Burner Association from a study of recent data of the U. S. Bureau of Mines, the Census Bureau and other sources, shows the total number of burners in operation in the United States in 1930 as 535,000. At present there is one oil burner for every 224 inhabitants—using, it is stated, an estimated total of 29,790,000 barrels, or 1,250,000,000 gallons.

The report reveals the steadily increasing use of the mechanical draft burners over the natural draft type, although until 1926 the natural draft burner remained the more popular of the two. In 1921 only 600,000 barrels of fuel oil were consumed for domestic heating, divided equally between mechanical and natural draft burners. In 1929 a total of 23,147,000 barrels was used—19,499,000 in mechanical draft burners. Natural draft burners outnumbered mechanical draft types in 1921 by 7,500 to 5,000. They continued to lead until 1925, when there were 103,000 natural draft burners to 78,500 mechanical draft. In 1926 the balance swung over to mechanical draft, when there were 113,900 of this type in operation against 72,375 of the other type. Of the 535,000 total now, 419,500 are mechanical draft.

Commercial installations have increased from 24,000 in 1925 to 39,200 in 1930 (estimated), and the fuel consumption has grown accordingly. Twelve million barrels were required by commercial units in 1925, while 18,200,000 barrels is the estimate for 1929. It is estimated that 19,600,000 barrels will be used for commercial heating in 1930.

The distribution of domestic burners by states shows that 18 states have 91.53 per cent of the total number of burners in use today. Illinois, where oil burners received their first important public test under the boilers of the Columbian Exposition in 1893, still is far ahead of any other state, with more than 131,000, or 24.5 per cent of the country's total. New York is the only state that approaches this number, with 19.2 per cent, or 103,000 burners. Together, the two states claim almost as many burners as the rest of the country combined. Pennsylvania and Massachusetts rank

third and fourth, with 6.58 and 6.34 per cent, respectively. Louisiana, with its ready access to supplies of fuel oil, has more burners than any other Southern state. Illinois has one oil burner for every 49 persons (based upon 1920 population census). New York, on the same basis, has one burner for every 101 persons; Pennsylvania one for every 249; and Massachusetts one for every 112.

Forty-five states and the District of Columbia are included in the association's report. Wyoming, Idaho, and Nevada were such slight users of liquid fuel that they were not considered in the general compilation.

ANALYSIS OF THE PROGRESS OF HEATING WITH OIL

(Based on Data of the U. S. Bureau of Mines, U. S. Bureau of Census, and Other Sources)

DOMESTIC OIL HEATING

Oil Consumption Barrels per Year

(Average consumption for mechanical draft burners 60 barrels per year; average consumption for natural draft burners 40 barrels per year.)

Year	Mechanical draft	Natural draft	Total	Light furnace oil	Heavy furnace or gas oil
1921	300,000	300,000	600,000	500,000	100,000
1922	540,000	500,000	1,040,000	640,000	400,000
1923	1,410,000	1,410,000	2,820,000	2,260,000	560,000
1924	2,840,000	2,180,000	5,020,000	3,855,000	1,165,000
1925	4,700,000	4,130,000	8,830,000	6,860,000	1,970,000
1926	6,820,000	2,895,000	9,715,000	6,805,000	2,910,000
1927	10,600,000	2,250,000	12,850,000	7,366,000	5,484,000
1928	14,340,000	2,863,000	17,203,000	8,369,000	8,834,000
1929	19,499,000	3,648,000	23,147,000	10,278,000	12,869,000
1930 (est.)	25,170,000	4,620,000	29,790,000	12,420,000	17,370,000

Number of Burners Operating

Year January 1	Mechanical draft	Natural draft	Total
1921	5,000	7,500	12,500
1922	9,000	12,500	21,500
1923	23,500	35,300	58,800
1924	47,300	54,500	101,800
1925	78,500	103,000	181,500
1926	113,900	72,375	186,275
1927	177,000	56,250	233,250
1928	239,000	71,575	310,575
1929	324,980	91,200	416,180
1930	419,500	115,500	535,000
1931 (est.)	514,500	140,500	655,000

Authority: American Oil Burner Association.

DISTRIBUTION OF DOMESTIC OIL BURNERS AS INDICATED BY FUEL OIL CONSUMPTION, BASED ON DATA OF THE U. S. BUREAU OF MINES, U. S. BUREAU OF CENSUS, AND OTHER SOURCES

State	1926 Per cent	1927 Per cent	1928 Per cent	1929 Per cent estimated	1930 Per cent estimated
Alabama	0.34	0.31	0.27	0.24	0.22
Arizona	0.02	0.02	0.01	0.01	0.01
Arkansas	0.47	0.42	0.34	0.28	0.24
California	2.14	1.91	1.65	1.58	1.51
Colorado	0.05	0.06	0.08	0.07	0.07
Connecticut	1.12	1.50	1.68	1.73	1.77
Delaware	0.02	0.02	0.02	0.01	0.01
District of Columbia	2.66	2.62	2.09	1.97	1.77
Florida	0.02	0.03	0.21	0.18	0.18
Georgia	0.14	0.16	0.38	0.38	0.39
Idaho	...	...	...	...	...
Illinois	21.10	21.50	22.90	23.70	24.50
Indiana	3.14	2.65	2.51	2.39	2.39
Iowa	0.56	1.11	1.11	1.16	1.14
Kansas	0.90	0.71	0.57	0.52	0.46
Kentucky	0.56	0.49	0.40	0.34	0.31
Louisiana	2.18	4.30	4.47	5.31	3.37
Maine	0.18	0.45	0.48	0.52	0.53
Maryland	0.20	0.20	0.25	0.26	0.27
Massachusetts	6.55	6.46	5.86	6.13	6.34
Michigan	3.99	3.76	3.80	4.06	4.28
Minnesota	2.27	3.12	3.28	3.31	3.23
Mississippi	0.11	0.09	0.08	0.07	0.07
Missouri	9.74	7.70	6.55	5.41	4.58
Montana	0.10	0.09	0.12	0.11	0.13
Nebraska	2.72	2.23	1.81	1.53	1.36
Nevada	...	...	...	...	...
New Hampshire	0.19	0.20	0.32	0.30	0.31
New Jersey	4.21	4.06	4.18	4.32	4.63
New Mexico	0.02	0.07	0.06	0.08	0.08
New York	18.69	17.50	17.80	18.50	19.20
North Carolina	0.09	0.08	0.08	0.08	0.08
North Dakota	0.02	0.02	0.02	0.02	0.02
Ohio	0.79	0.97	1.01	1.03	1.02
Oklahoma	0.16	0.52	0.49	0.49	0.48
Oregon	0.24	0.20	0.19	0.19	0.19
Pennsylvania	7.09	6.41	6.28	6.47	6.58
Rhode Island	1.18	2.19	2.23	2.25	2.26
South Carolina	1.14	1.05	0.95	0.85	0.78
South Dakota	0.01	0.05	0.05	0.05	0.05
Tennessee	0.03	0.14	0.16	0.17	0.18
Texas	1.77	1.78	1.57	1.46	1.36
Utah	0.18	0.20	0.18	0.16	0.15
Vermont	0.17	0.17	0.30	0.31	0.31
Virginia	0.06	0.05	0.12	0.12	0.12
Washington	0.71	0.59	0.57	0.56	0.55
West Virginia	0.06	0.05	0.04	0.04	0.03
Wisconsin	1.80	1.92	1.94	2.01	2.01
Wyoming	...	...	...	...	...

Authority: American Oil Burner Association.

COMMERCIAL OIL HEATING

According to the U. S. Bureau of Mines, there was a total of 33,400 commercial installations in operation during 1928, which consumed a total amount of 16,704,000 barrels of fuel oil.

ESTIMATED OIL CONSUMPTION FOR COMMERCIAL HEATING

BASED ON BUREAU OF MINES 1928 SURVEY

Average Consumption for Commercial Installations, 500 Barrels per Year

Year	No. of installations	Total fuel oil barrels
1925	24,000	12,000,000
1926	27,800	13,875,000
1927	31,500	15,750,000
1928	33,400	16,704,000
1929 (est.)	36,400	18,200,000
1930 (est.)	39,200	19,600,000

Authority: American Oil Burner Association.

UTILIZATION OF FUEL OIL AND GAS OIL

The principal consuming agencies for fuel oil and gas oil are the merchant marine, the railroads, the oil producing and refining industry, gas and electric power plants, the iron and steel industry; and homes, apartments, etc., using oil for domestic and commercial heating. The U. S. Navy, now on an oil-burning basis, is a large consumer of fuel oil; while the use of fuel oil in industry embraces almost every field employing heat and power. Smelters and mines consume as much as the U. S. Navy. Food industries, ceramic industries, cement and lime plants, logging and lumbering, paper and wood pulp manufacturers; the textile, chemical, and automotive industries are some of those employing oil fuel for which statistics of consumption are available.

A survey of gas oil and fuel oil distribution in the United States during 1928 was made by the U. S. Bureau of Mines, in cooperation with the American Petroleum Institute; and the uses are shown in the table on page 125.

The Pacific Coast states, farthest removed from coal sources, lead in the regional consumption of fuel oil; and are followed by the South Central and Middle Atlantic states.

Both the Pacific Coast and Middle Atlantic areas showed a proportional increase over the consumption of the two preceding years; while the South Central area, although second in the total amount consumed, showed a slight decrease in comparison with the remainder of the distribution. The demand in the North Central area, including mainly the states bordering the Great Lakes, continued the increase noted during the two preceding years; while the New England area, the South Atlantic states and the Rocky Mountain region showed both actual and proportional decreases.

NATIONAL DISTRIBUTION OF GAS OIL AND FUEL OIL

(In Barrels of 42 U. S. Gallons)

Uses	1928	1927	1926
Railroads	70,694,754	69,847,778	72,217,652
Steamships (including tankers)	86,585,673	88,215,028	79,287,605
Gas and electric power plants	30,505,943	30,021,410	33,651,513
Smelters and mines	7,020,976	6,831,275	8,951,817
Iron and steel products	19,180,303	18,335,830	16,102,458
Chemicals and allied industries[1]	3,494,922	2,080,507	.....
Automotive industries	2,212,495	1,686,605	1,603,393
Textiles and their products[1]	4,586,306	4,852,204	.....
Paper and wood pulp[1]	2,792,752	3,131,043	.....
Logging and lumbering	2,578,133	2,370,449	3,183,597
Cement and lime plants	5,223,887	5,051,051	5,586,144
Ceramic industries	2,878,531	3,270,036	3,216,850
Food industries	6,485,226	7,151,361	7,674,766
Other manufacturing	10,030,960	11,130,809	23,017,235
Commercial heating	16,704,335	15,750,506	13,874,181
Domestic heating	5,667,027	5,233,745	2,905,401
U. S. Navy, Army transports, etc.	6,814,501	6,505,869	6,541,638
Used as fuel by oil companies	50,037,039	43,452,584	48,701,023
Miscellaneous uses	12,757,596	9,353,849	7,514,599
Total domestic deliveries	346,251,359	334,271,939	334,029,872
Exports and other shipments	44,428,543	47,390,862	38,620,895
Total distribution	390,679,902	381,662,801	372,650,767

[1] Deliveries to chemical and allied industries, textiles and their products, and paper and wood pulp were included under "other manufacturing" in the 1926 survey.

Authority: U. S. Bureau of Mines.

Distribution of Gas Oil and Fuel Oil, by States

(In Barrels of 42 U. S. Gallons)

States	1928	1927	1926
Alabama	375,979	405,987	1,072,713
Arizona	3,825,339	2,680,687	3,697,676
Arkansas	2,477,979	2,210,142	1,802,026
California	90,156,084	89,844,872	86,615,334
Colorado	585,615	884,008	420,470
Connecticut	2,200,037	2,594,200	2,285,601
Delaware	502,089	640,745	884,014
District of Columbia	1,024,303	971,962	758,570
Florida	5,646,001	7,397,119	9,210,297
Georgia	1,255,022	1,349,465	1,504,206
Idaho	33,432	30,083	61,391
Illinois	13,493,061	11,445,021	8,992,051
Indiana	4,972,127	4,267,609	3,090,862
Iowa	786,897	659,790	666,153
Kansas	5,678,993	4,815,814	5,164,216
Kentucky	370,550	403,113	259,016
Louisiana	16,299,608	18,206,587	20,657,892
Maine	762,484	1,273,031	1,617,447
Maryland	5,877,096	5,113,530	5,291,471
Massachusetts	11,239,933	11,975,634	12,080,091
Michigan	3,289,327	2,965,662	2,398,041
Minnesota	1,478,911	1,404,070	979,585
Mississippi	334,234	334,915	413,757
Missouri	4,774,288	5,296,509	5,146,747
Montana	2,163,014	2,824,720	2,352,173
Nebraska	616,393	670,586	748,547
Nevada	993,778	815,351	587,372
New Hampshire	111,815	153,594	175,590
New Jersey	20,039,208	19,676,970	14,928,682
New Mexico	418,719	386,931	271,645
New York	37,007,278	34,332,686	35,951,626
North Carolina	200,348	214,626	321,741
North Dakota	63,202	25,070	40,182
Ohio	4,870,664	3,870,626	3,138,376
Oklahoma	10,450,669	8,846,551	8,704,423
Oregon	6,877,971	5,269,714	6,066,230
Pennsylvania	16,210,341	14,504,333	17,291,204
Rhode Island	4,150,619	4,654,374	4,567,337
South Carolina	792,363	980,034	1,284,195
South Dakota	130,332	106,046	121,909
Tennessee	759,965	485,019	367,703
Texas	46,074,931	44,500,450	47,999,196
Utah	398,682	429,494	376,494
Vermont	213,694	140,942	73,212
Virginia	1,223,729	1,508,343	1,516,369
Washington	10,652,432	8,183,611	7,358,520
West Virginia	468,030	394,144	415,806
Wisconsin	1,474,385	1,411,161	1,101,141
Wyoming	2,449,408	2,716,008	3,200,572
Total, U. S.	346,251,359	334,271,939	334,029,872

Authority: U. S. Bureau of Mines.

REGIONAL DISTRIBUTION OF DELIVERIES, 1926-1928
(In Barrels of 42 U. S. Gallons)

Region	1928		1927		1926	
	Barrels	Per cent	Barrels	Per cent	Barrels	Per cent
Pacific Coast	112,505,604	28.80	106,794,235	27.98	104,325,132	28.00
South Central	86,466,681	22.13	84,616,955	22.17	90,960,970	24.41
Middle Atlantic	80,660,315	20.65	75,240,226	19.71	75,105,567	20.16
North Central	32,305,814	8.27	27,713,773	7.26	21,903,566	5.88
New England	18,678,582	4.78	20,791,775	5.45	20,799,278	5.58
South Atlantic	9,585,493	2.45	11,843,731	3.10	14,252,614	3.82
Rocky Mountain	6,048,870	1.55	7,271,244	1.91	6,682,745	1.79
Total domestic	346,251,359	88.63	334,271,939	87.58	334,029,872	89.64
Exports and shipments	44,428,543	11.37	47,390,862	12.42	38,620,895	10.36
Total distribution	390,679,902	100.00	381,662,801	100.00	372,650,767	100.00

Authority: U. S. Bureau of Mines

OIL FOR VESSELS

The application of oil burning to marine transportation increased rapidly during the early part of the post-war decade. On June 30, 1920, the merchant marine of the world fitted to burn oil had a registered gross tonnage of 9,000,000 tons. Each succeeding year showed an increase in registration—particularly rapid until 1925. Since that date the gross tonnage of oil-burning steamers has continued to increase (amounting to 24,417,000 tons, including motor vessel tonnage in 1929), but at a somewhat lower rate than in the earlier years. (See "World Production and Consumption of Petroleum: World Oil Burners.")

Registration of motor ships during the past five years, on the other hand, indicates a trend towards that type of marine transportation which is commensurate with the conversion of steamers to oil-burning during the period 1914-1919. World motor ship registration has increased from 1,248,000 gross tons in 1923 to 5,604,000 gross tons in 1929.

Of the total bunker oil deliveries during 1928, 39.5 per cent were made at Pacific Coast ports; 40.8 per cent at Atlantic Coast ports; 19.3 per cent at Gulf Coast ports; and 0.4 per cent at inland lake and river ports. The latter figures include a small quantity of fuel oil delivered to river dredging operations. Total deliveries declined from 88,215,028

barrels in 1927 to 86,585,673 barrels in 1928. Inasmuch as bunker oil deliveries to vessels engaged in foreign trade increased from 50,060,574 barrels in 1927 to 51,205,198 barrels in 1928, according to reports made to the Bureau of Foreign and Domestic Commerce, it follows that bunker oil requirements of vessels engaged in domestic or inter-coastal trade decreased by approximately 3,000,000 barrels. Inasmuch as the tanker movement of crude and refined petroleum products undoubtedly constitutes the major portion of domestic and inter-coastal traffic, and the tanker movement from California to Atlantic Coast ports was smaller in 1928 than in 1927, the decrease in domestic or inter-coastal bunker oil requirements may be attributed primarily to the smaller inter-coastal movement of petroleum products.

OIL FOR RAILROADS

Southwestern and Pacific Coast railroads are the principal users of oil for locomotive fuel. Oil-burning locomotives have been in operation since the early nineties.

FUEL OIL CONSUMPTION, PRINCIPAL RAILROADS *

(Barrels of 42 U. S. Gallons)

District	1928	1927	1926	1925
California	24,616,364	24,595,556	24,042,341	24,563,663
Oregon-Washington	6,221,628	5,929,142	5,595,818	5,291,603
Rocky Mountain	2,127,929	2,457,273	2,423,783	2,419,729
North Central	173,083	190,551	155,584	159,476
South Central	32,177,081	31,149,162	31,971,445	32,674,904
Atlantic	2,712,111	3,113,811	4,203,419	4,351,744
Total	68,028,196	67,435,495	68,392,390	69,461,119

* Class I.

Authority: Interstate Commerce Commission.

The number of oil-burning locomotives operated by Class I railroads increased from 4,140 in 1914 to 7,373 in 1924. Since the latter year, there has been only a slight increase, the number available for service at the end of 1928 being 7,472. On the 1928 consumption of 68,028,196 barrels

reported by the principal oil-burning railroads, 60,243,115 barrels were consumed in locomotives and 7,785,081 barrels were consumed as fuel in repair and machine shops, ferry boats, tugs, and other marine equipment; in starting fires in coal-burning locomotives, and for such miscellaneous uses as preserving cross-ties and timbers, oiling roadbeds, and as a fuel for weed-burners, snowplows, and commissary ovens.

At the end of 1928, 20 oil-electric locomotives were reported in service on Class I railroads; one was delivered in March 1929, and five more were under construction during the first half of 1929. With but two exceptions, the oil-electric locomotives in service at the end of 1928 were used by the railroads only in switching service. The total consumption of Diesel oil reported for these locomotives during 1928 amounted to 7,662 barrels. In addition to the 20 oil-electric locomotives in service on Class I railroads, 14 other oil-electric locomotives have been placed in switching service at various industrial plants and two others on a smaller railroad, making a total of 36 oil-electric locomotives available for service at the end of 1928.

OIL FOR GAS AND POWER PLANTS

The total quantity of gas oil and fuel oil delivered to gas and electric power plants in the United States during 1928 reached a total of 30,506,000 barrels, of which approximately 76 per cent was consumed by the manufactured gas industry and 24 per cent in the generation of electric power.

Oil Consumption by Manufactured Gas Industry

(Barrels of 42 U. S. Gallons)

	1928	1927	1926
In water gas carburetion	16,226,786	16,927,283	17,809,357
In oil gas production	6,102,881	6,113,779	5,909,571
As fuel for heating	582,524	372,196	494,881
Total	22,912,191	23,413,258	24,213,809

Authority: American Gas Association.

The foregoing table shows a constant decrease during the past three years in the quantity of gas oil required for the carburetion or enrichment of manufactured gas. Among the several factors contributing towards the decrease may be mentioned the increased production of coal gas and increased purchase of coke-oven, natural, and refinery still-gases.

The completion during 1929 of the pipe line making natural gas available to the San Francisco area has resulted in a major decrease in the fuel oil requirements of the plants which supplied this region with manufactured gas.

During the past decade, approximately 90 per cent of the fuel used in the generation of electric power has been coal; while natural gas has supplanted oil as the fuel of second importance in this use. During this period, the consumption of coal has increased 12 per cent; fuel oil has decreased 35 per cent; and natural gas has increased 261 per cent.

FUEL BURNED AT REFINERIES

For the year 1928, petroleum refineries are reported by the U. S. Bureau of Mines to have consumed the following quantities of fuel: 46,400,000 barrels of fuel oil; 3,362,000 short tons of coal; 114,950,000,000 cubic feet of natural gas; 77,313,000,000 cubic feet of refinery or still gases; and 470,000 short tons of petroleum coke, in addition to a small quantity of electrical energy.

The total of 46,400,000 barrels of fuel oil burned represents an increase over 1927 of about 5,000,000 barrels, which made it about equal to the 1926 figure. Virtually all of the refining districts reported an increased use of fuel oil in 1928.

OIL FOR COMMERCIAL AND DOMESTIC HEATING

The 1928 demand for gas oil and fuel oil for commercial and domestic heating called for the delivery of 22,371,362 barrels, as compared with 20,984,251 barrels in 1927. Heat-

ing of office buildings, apartments, schools, hotels, hospitals, and other buildings required 16,704,335 barrels in 1928, as compared with 15,750,506 barrels in 1927; while 5,667,026 barrels were delivered to homes for domestic heating in 1928, as compared with 5,233,745 barrels in 1927.

These figures represent reported deliveries of gas and fuel oil, and do not include furnace oils and lighter distillates delivered for domestic heating. The authority is the U. S. Bureau of Mines.

DEVELOPMENT OF DIESEL POWER

The development of Diesel power for marine service received a great impetus from the wonderful records made by this type of engine in the submarines of the various navies during the World War. Their performance definitely established the reliability of this type of prime mover. Immediately after the war, various engineering companies all over the world took up the development of the Diesel, with the result that from the earlier engines weighing about three hundred pounds per horsepower and running at slow speeds, design has progressed to engines weighing less than three pounds per horsepower and turning at the rate of a thousand revolutions per minute.

To the use of Diesel power on land and sea is apparently soon to be added its employment in the air. Radial air-cooled Diesels weighing under three pounds per horsepower are being tried out for airplane use.

As evidence of the increasing favor with which Diesel power is regarded for marine work: In 1924 Diesel engine tonnage comprised 19½ per cent of the total world tonnage under construction. Now it is almost 50 per cent.

The sales of Diesel engines for land installation in the United States totaled 440,000 horsepower in 1928.

On land the development of Diesel engines for central station work has progressed so that there are now many giant Diesel plants scattered all over the world. Among

those of particular interest are the Panama Canal plant at Miraflores, comprising 12,375 brake horsepower in three engines; the 15,000-horsepower Diesel electric plant at Hamburg, Germany; the 20,000-horsepower Diesel electric central station at Shanghai, China, and many others. The Diesel is coming into increasing favor for pipe line pumping operations, also in locomotive switching service; and there is at least one Diesel-driven motor truck now in successful use.

UTILIZATION OF LUBRICATING OILS

Petroleum lubricants have played an indispensable part in the mechanical development of the past three-quarters of a century.

In the memory of men now living, the only lubricants in use were those made from animal fats and from various vegetable substances. Machinery was crude, cumbersome, and slow, owing to the lack of lubricants that would give efficient lubrication to fast moving parts or that could be applied efficiently.

Practically every mechanical device used today not only employs petroleum lubricating oil in its operation, but its development was made possible only through the development of suitable lubricants. (See " Petroleum Lubricants and the Machinery Age," Petroleum Facts and Figures, Second Edition.) The modern world without petroleum lubricants is almost unimaginable.

It is apparent that a wide variety of lubricants is necessary to meet the needs of modern industry. Not only does each industry present a need for lubricants especially designed for its requirements; but machines, designed to do the same work, differ in their details to such an extent that a lubricant suitable for one manufacturer's machine is unsuited for a somewhat similar machine made by another manufacturer.

The most familiar example of this is the automobile. To meet the needs of all automobiles on the road, one lubricating oil concern manufactures five or six different oils for crankcase use alone, and as many more different products for other parts of automobiles. The ideal oil for one car may well be considered absolutely unsuited for another. Steam turbines, alike in general principles and operating conditions, require several different oils in order to meet the design characteristics of the products of various manu-

facturers. For paper mill machinery, nearly a dozen different oils are necessary, each machine calling for the use of several different kinds.

To meet modern conditions, scores of different kinds of oil are necessary. To produce these oils, specialists in lubrication must study not only the crude oil from which they are to be made, but must develop treatments and processes to bring out the various desired qualities and characteristics. They must also have engineering knowledge of the uses to which the oils are to be put. The industry must constantly look ahead in order to anticipate the demands of engine builders.

The average citizen has a very small conception of the extent to which he is dependent upon lubrication. His clothes are machine woven and machine sewed only because lubricants have made possible the development of high speed machinery for the work. He has running water in his home only because means have been found to lubricate pumping machinery. Electricity is his at the turn of the switch because lubricants have been developed for the high speed machinery necessary for its production, and because other petroleum products have made possible the transmission of the current over long distances. His automobile could run only a few feet without lubrication—and lubrication of a highly specialized kind. Railroad trains could not operate at any speed comparable with modern conditions had not suitable lubricants been devised for the fast moving parts. The safety devices which make modern railroad travel safe would be inoperative without lubrication.

Without lubrication, practically the only kind of work that could be done by any industry would be that which could be performed by manual operation of the simplest devices.

UTILIZATION OF ASPHALT AND ASPHALTIC PRODUCTS

Asphalt is the semi-solid, black sticky residue, produced by the partial distillation of certain petroleums. By a process of natural evaporation, asphalt has been produced likewise in certain deposits, at or below the earth's surface, which products are most commonly known as lake asphalt and rock asphalt. Of all the asphalt produced and consumed in the United States, however, the greatest bulk is refined directly from petroleum, and is known as petroleum asphalt.

In addition to the semi-solid and solid asphalts, a variety of fluid products, containing a relatively high percentage of asphalt, are obtained by distilling petroleum. To this class belong the residual road oils and fluxes. These products have not been distilled sufficiently to reduce the residue to the consistency of asphalt. Other fluid products, produced by combining the semi-solid or solid asphalts with such distillates as gasoline or kerosene, are known as cut-back asphalts, and have the property of hardening with a rapidity that is dependent upon the volatility and quantity of the distillate used in their preparation.

Asphalt is a highly cementitious, plastic material; and is used principally as a binder or cementing medium. It is waterproof and resistant to the attack of most acids; and these properties, together with its cementitiousness, make it of great value for numerous and widely varied industrial purposes.

From 1918 to 1929 the annual production of petroleum asphalt in the United States increased from 1,202,420 tons to 4,724,000 tons. This was due largely to the tremendous expansion in city asphalt pavement and rural highway asphalt construction.

Asphalt and Asphaltic Materials Manufactured in the United States from Petroleum and sold at Refineries, 1928 and 1929, by Varieties

(Value f. o. b. refinery)

Product	Solid and semi-solid products of less than 200 penetration (Asphalt)		Semi-solid and liquid products of more than 200 penetration (Flux) (a)		Grand total	
	Short tons	Value	Short tons	Value	Short tons	Value
1928						
From domestic petroleum:						
Paving (b)	636,533	$8,867,658	28,320	$404,535	644,853	$9,272,193
Roofing and waterproofing (c)	358,185	4,371,105	94,609	1,079,293	452,794	5,450,398
Mineral rubber (d)	127,417	1,382,847	245	10,236	127,662	1,393,083
Road oil (e)	3,812	72,897	.....	.....	3,812	72,897
Other (f)	.....	.....	721,712	5,860,301	721,712	5,860,301
	75,864	864,050	72,551	582,362	148,415	1,446,412
Total	1,201,811	15,553,557	917,437	7,936,727	2,119,248	23,495,284
From foreign petroleum:						
Paving (b)	912,821	12,403,651	98,857	1,740,128	1,011,678	14,143,779
Roofing and waterproofing (c)	587,388	7,644,364	172,082	1,937,792	759,470	9,582,156
Mineral rubber (d)	208,952	2,418,378	.....	.....	208,952	2,418,378
Road oil (e)	17,862	233,529	.....	.....	17,862	233,529
Other (f)	.....	.....	89,399	1,054,051	89,399	1,054,051
	98,887	1,258,628	77,889	997,092	176,776	2,255,720
Total	1,825,910	23,958,550	438,227	5,729,063	2,264,137	29,687,613
Grand total	3,027,721	39,517,107	1,355,664	13,665,790	4,383,385	53,182,897
1929						
From domestic petroleum:						
Paving	547,176	$7,194,382	54,919	$571,400	602,095	$7,765,782
Roofing	601,155	6,461,699	86,552	797,807	687,707	7,259,506
Waterproofing	43,192	629,209	22,515	225,776	65,707	854,985
Mineral rubber	2,481	67,168	.....	.....	2,481	67,168
Briquetting	53,367	551,483	.....	.....	53,367	551,483
Mastic	1,364	23,686	.....	.....	1,364	23,686
Pipe coatings	7,868	125,282	.....	.....	7,868	125,282
Moulding compounds	40	1,004	.....	.....	40	1,004
Road oils	.....	.....	75,509	1,481,599	75,509	1,481,599
Cut-back asphalts	.....	.....	21,801	314,842	21,801	314,842
Emulsified asphalt and fluxes	.....	.....	148	5,320	148	5,320
Paints, enamels, japans, lacquers	.....	.....	.....	.....	.....	.....
Miscellaneous	128,540	854,651	79,856	412,188	208,396	1,266,839
Total	1,385,183	15,908,564	341,300	3,808,932	1,726,483	19,717,496
From foreign petroleum:						
Paving	1,022,682	12,268,078	130,924	2,187,394	1,153,606	14,455,472
Roofing	560,466	6,006,730	328,431	2,994,305	888,897	9,001,035
Waterproofing	62,249	742,508	.....	.....	62,249	742,508
Mineral rubber	22,843	250,703	.....	.....	22,843	250,703
Briquetting	11,768	145,224	.....	.....	11,768	145,224
Mastic	425	6,395	82	678	507	7,073
Pipe coatings	4,914	74,586	.....	.....	4,914	74,586
Moulding compounds	2,239	23,991	.....	.....	2,239	23,991
Road oils	.....	.....	607,179	4,861,210	607,179	4,861,210
Cut-back asphalts	.....	.....	107,894	1,359,404	107,894	1,359,404
Emulsified asphalt and fluxes	.....	.....	14,662	175,944	14,662	175,944
Paints, enamels, japans, lacquers	.....	.....	210	6,653	210	6,653
Miscellaneous	80,565	350,073	40,319	409,492	120,884	759,565
Total	1,768,151	19,868,288	1,229,701	11,995,080	2,997,852	31,863,368
Grand total	3,153,334	35,776,852	1,571,001	15,804,012	4,724,335	51,580,864

(a) Flux: Liquid asphaltic material used in softening native asphalt or solid petroleum asphalt for paving, roofing, waterproofing, and other purposes.

(b) Paving asphalt: Refined native asphalt and asphaltic cement, fluxed and unfluxed, produced for direct use in the construction of sheet asphalt, asphaltic concrete, asphalt macadam, and asphalt block pavements, and also for use as joint filler in brick, block and monolithic pavements.

(c) Roofing and waterproofing asphalt: Asphalt and asphaltic cement used in saturating, coating and cementing felt or other fabric and in the manufacture of asphalt shingles.

(d) Mineral rubber: Asphalt and asphaltic cement used by the rubber industry.

(e) Road oil: Residual asphaltic oil used for surface treatment. The amount shown for domestic petroleum includes 377,856 tons in excess of the original compilation. This tonnage was later separated from miscellaneous petroleum products but at date of publication has not been apportioned between domestic and foreign petroleum.

(f) Other solid and semi-solid products: Asphalt and asphaltic cement used as dips and in the manufacture of insulating materials, acid-resisting compounds, putty, mastic, and briquets and not included in the preceding definitions. Other liquid products: petroleum asphalt used in the manufacture of saturant, paint, varnish or other coating, exclusive of fuel oil and not included in the preceding definitions.

Authority: U. S. Bureau of Mines.

ASPHALT PAVEMENTS LAID IN UNITED STATES

Year	Square yards	Year	Square yards
1922	90,000,000	1926	133,000,000
1923	108,000,000	1927	144,000,000
1924	125,000,000	1928	127,000,000
1925	130,000,000	1929	132,000,000

Authority: Asphalt Institute.

During recent years the use of asphaltic road oils and cut-back asphalts in the treatment and construction of low-cost and secondary roads has increased very rapidly; and it seems probable that future developments along this line shortly will more than double the present consumption of asphalt. Asphalt is considered of particular value in building landing strips, parking spaces, runways, and taxiways at the modern airports which are now being constructed in all parts of the country. The asphalt pavement or roadway, being flexible as well as waterproof, is particularly well adapted to re-surfacing and salvaging highways that are now obsolete, but which are sufficiently substantial to serve as foundations. In such cases the asphalt is utilized merely by laying a relatively thin asphaltic wearing-course over the old roadway.

The asphalt roofing industry has grown to enormous proportions in recent years, since this type of relatively low-cost roofing has become exceedingly popular because of its durability and pleasing appearance. Several types of roofing have been devised, including smooth-roll roofing, slate-roll roofing, strip shingles, and individual shingles. The present annual production of the various types of asphalt roofing is sufficient to cover more than 363,000,000 square yards of roof surface.

APPENDIX

CONSERVATION OF PETROLEUM

CHRONOLOGY OF DEVELOPMENTS *

While no accord on a definite petroleum conservation plan was reached at the Hoover conference at Colorado Springs in June 1929, shortly thereafter a growing tendency practically to apply conservation to field problems became evident. There was a decided trend toward voluntary agreements for curtailment of production, pro-ration in flush and semi-flush fields, cooperative or unit development and operation of oil pools, and widespread study of the relation of petroleum conservation to all branches of the industry.

California operators, meeting in June of that year to discuss a voluntary production curtailment plan, generally agreed to reduce field output some 207,000 barrels daily. Full cooperation was not forthcoming, however; and on June 24 F. C. Van Deinse, California oil umpire, resigned; the cooperative plan was abandoned, and conservation—insofar as the California fields were concerned—was relegated to the provisions of the new state gas conservation law, effective August 31. Three days later the state notified all operators that unreasonable waste of natural gas, estimated at more than 600,000,000 cubic feet daily, must cease August 31 in accordance with the new law, and that no extension would be allowed.

In the Mid Continent fields voluntary conservation methods made progress. On June 27 Texas operators asked the State Railroad Commission to extend the Yates field pro-ration plan another six months. The commission replied, July 1, by increasing the curtailment to 130,000 barrels daily from 100,000 barrels for the requested six months. About the same time, the U. S. Bureau of Mines reported that oil production and stocks in May had reached new all-time peaks, due mainly to increased output in Texas, Oklahoma, and Kansas.

A repercussion of the Hoover conference was heard in Oklahoma, where, on July 1, the state delegation, reporting to Governor Holloway, recommended that any future conference to formulate an interstate conservation pact be limited to

* See " Petroleum Facts and Figures," first edition, p. 227; and second edition, p. 223, for chronological summary of developments in conservation movement—1924 to June 1929.

three, or possibly six, states. It was pointed out that difference in conditions, particularly in the Rocky Mountain states, where public lands were an issue, precluded any possibility of meeting for discussion on common ground.

The conservation policy of President Hoover, made public the previous March in his announcement that after that date no lease or disposal of government oil land would be made, was attacked July 10 in District of Columbia supreme court. Mandamus proceedings directed against Secretary of the Interior Wilbur were instituted by oil prospectors to test the legality of the President's action.

During June and July operators in the Kettleman Hills field of California were in conference with representatives of the federal government on a plan for development of this prolific new field. On July 12 it was announced that, under a revised plan, it was proposed to suspend drilling generally in the north dome until July 1, 1931. Agreement on the plan was reached July 21. On the same day Secretary Wilbur, answering the suits for writ of mandamus in the public land case, declared that prospecting permits were a privilege and not a right, and that granting or rejection of such permits was within the power of the Secretary of the Interior, over whose office the courts had no power of review.

Operators in Winkler County, Texas, on July 24, unanimously approved adoption of pro-ration practice to the area surrounding the Hendricks field development.

Conservation in effect became a policy of the marketing branch of the industry, July 25. The National Code of Practices for Marketing Refined Petroleum Products, sponsored by the American Petroleum Institute in an effort to prevent waste, improve marketing ethics, and remedy other ills growing out of intense competition, on that day was approved by the Federal Trade Commission. It became effective immediately. Directors of the Institute, meeting July 30 at New York, adopted a resolution recommending the code to the industry, and constituted a National Committee on Interpretation of the Code, as well as state code committees.

CURTAILMENT EFFORTS SUCCESSFUL

The U. S. Bureau of Mines report for June, published August 2, indicated that some success had attended production curtailment efforts. The report showed that crude oil output again had established a new high record, but that it was due chiefly to increased production in California, where practical

conservation methods were not fully applied. Immediately after publication of the Bureau of Mines report there was an evident tendency to tighten restrictions on output and to agitate for curtailment of production in various oil producing states, culminating, late in August, in an agreement of operators in the Oklahoma City pool to shut down the pool's entire production for one month.

President Hoover, in a letter dated August 27, and read before the conference of governors of public land states, at Salt Lake City, Utah, announced as his policy, subject to the approval of Congress, a proposal to transfer to the states all federal land holdings. The federal government, however, would retain control of petroleum and other minerals.

The California gas conservation law legally became effective August 31. Plans were made, with state aid, for the disposal of surplus natural gas to cities and to other oil fields for repressuring purposes. Although it was proposed to take the excess gas pro-rata from the various operators, there were objections, the first in a series that grew into continued court action. Cooperation was not forthcoming, and on September 11 the state filed suit in Los Angeles superior court for a temporary injunction restraining all operators in the Santa Fe Springs field from unreasonable wastage of natural gas. A few days later several California operators agreed on a plan to pool natural gas production and marketing outlets, forming the California Cooperative Gas Conservation Association, with a managing committee of 14, representing the various interests, authorized to direct activities of the association along lines indicated by state officials. On September 20, and again on September 30, certain operators successfully sought delay in enforcement of the gas conservation law pending study of field problems and of the statute itself. Further hearings were postponed until October 14, and later were adjourned to October 31.

Oklahoma operators, during September, sought and obtained further reduction of output. The Oklahoma Corporation Commission on September 12 ordered the entire Oklahoma City pool shut down for 30 days, and on September 28 directed that the East Earlsboro pool be put on 50 per cent pro-ration, also for one month. On September 30 operators in the Wright and Valley Center pools, chief producing areas of Kansas, agreed upon a plan to pro-rate production 50 per cent for 30 days beginning October 5.

Early in October a letter from Secretary Wilbur, read before the convention of the American Institute of Mining and Metallurgical Engineers at San Francisco, set forth administration

belief that " we must proceed to the proper conservation of the oil and gas and coal resources of the country, and we must view our mineral supply, including our mineral fertilizers, as problems of a national, as well as of a local, character."

On October 3 the State of California directed operators in the Ventura field to discontinue the practice of wasting natural gas, effective October 9. The operators at once began work on a plan to pool the excess gas. Their efforts were furthered, October 13, by " independent " operators who proposed immediate curtailment of drilling and producing in Santa Fe Springs, Long Beach, Huntington Beach, and Seal Beach fields; and ratified an agreement for cooperative gas conservation. A few days later operators who had opposed the state's suit in connection with the Santa Fe Springs field moved, in superior court, to make all interests in the field, such as lessors, royalty holders, and others, party to the suit. They also asked the District Court of Appeals for an order restraining the Los Angeles superior court from taking immediate action. The state carried the case to the supreme court.

Then a new method was tried in an effort to curtail California's production. Posted prices for crude oil were cut 50 per cent on October 19, purchasers explaining the reduction as being due to continued overproduction in the face of legal and voluntary efforts to shut off the flow of oil.

In Oklahoma a general pro-ration plan, enforced by the State Corporation Commission, became effective October 16, placing all pools of the state under pro-ration orders until January 1, 1930. On October 21 operators in the Oklahoma City pool decided to try a new method of carrying out the terms of the pro-ration order by dividing wells into two groups, each group to be shut in and opened alternately for four-day periods until November 21. All wells were to be shut down on Sundays.

Thinking to assure application of his conservation policies to public lands, President Hoover on October 18 announced the appointment of a Commission on Conservation and Administration of the Public Domain. Its duties were to advise the federal government as to best methods for developing and using land in public land states to which the federal government holds title as proprietor.

CONSERVATION AND THE LAW

Legal minds of the country renewed their interest in conservation October 22. On that date a committee of the American Bar Association, reporting to the annual convention at

Memphis, Tenn., recommended enactment of federal legislation "to promote conservation of petroleum, natural gas, and other minerals, to avoid waste, and to encourage underground reserves." The committee suggested that, under such legislation, agreements between producers for curtailment of drilling or production of minerals would be held not in violation of laws or acts of Congress forbidding monopolies or agreements in restraint of interstate or foreign commerce. The report favored unit development and operation of oil lands, and advocated giving the petroleum industry the advantages held by other industries in stopping or limiting output during periods of overproduction. The committee advised removing state anti-trust laws, if and when they are obstacles to conservation. Further, it recommended enactment of legislation designed to provide for compulsory cooperative development and operation of oil pools, when two-thirds of the operators in a pool were agreed, and declared the industry could not, and should not, be subjected to any far-reaching scheme of governmental interference or regulation.

Production curtailment was extended in late October and early November. Reduction of production in California was brought about on October 25 on agreement by operators in the Santa Fe Springs, Signal Hill, Ventura, and Seal Beach fields to reduce output, beginning November 1, sufficient to lower the state's daily average yield 30 per cent for three months.

On October 30 production was ordered reduced to 40 per cent of potential in certain fields of Howard and Glasscock Counties, Texas. On November 1 the Oklahoma City and East Earlsboro pools of Oklahoma were put on a 40 per cent pro-ration basis for November and 50 per cent for December. Other flush pools were curtailed 20 per cent for November. When, on November 5, the pro-ration order covering Winkler County, Texas, expired, it was agreed to renew it to May 5, 1930.

DEMAND AND SUPPLY BALANCED

Results of this widespread curtailment program were seen in the announcement November 1 by President E. B. Reeser, of the American Petroleum Institute, that a balance between production and consumption had been established. "We have for the first time," he said, "all flush producing fields of the United States pro-rating their yields to the requirements of the market." Another result was that on November 6 crude oil prices in California were restored to their former levels.

November brought other new developments. Seeking to expedite the operation and development of oil pools on the unit, or cooperative plan, the Mid Continent Oil and Gas Association appointed committees of land men and attorneys to study technical and legal questions involved. The committees' reports were adopted and approved November 21.

On November 8 the State of California filed suit to enjoin operators in the Signal Hill field from wasting natural gas.

On November 14 a new suit was brought in District of Columbia supreme court to contest the right of Secretary Wilbur to withhold permits for prospecting on public lands. Operators in the Rocky Mountain states on November 21 adopted a resolution requesting President Hoover to withdraw his executive order under which Secretary Wilbur refused to issue such permits. The resolution also appealed to state legislatures to enact laws permitting the leasing of state lands for an indefinite period.

The importance of petroleum conservation was stressed anew on December 1. Secretary Wilbur, making his first annual report as Secretary of the Interior, termed it "our fastest dwindling irreplaceable asset." He declared responsibility for the prevention of waste rested with the petroleum industry and the oil producing states, and added: "The time has come when conservation of the nation's oil resources must be regarded as a national strategy to be settled by agreement of interests across the table top rather than by conflict thousands of feet underground."

The position of the Institute on the question of conservation, as well as on the industry's place in the country's economic structure, were shown December 2 in a resolution adopted by the Institute's board of directors, gathered for the tenth annual meeting at Chicago. Replying to a request of President Hoover for a statement on the business outlook, and suggesting publicly for the first time that the needs of petroleum conservation best could be served by a reduction of refinery gasoline production, the directors said:

"The petroleum industry is strikingly important in its relation to the economic life and social welfare. It occupies, by force of the essential nature of its products, a position of outstanding significance to general prosperity. It is closely related to all industry and to the everyday life of the individual. If the revolutionary industrial changes of recent years have been in speed and spread, rather than in fundamental structure, as the Committee on Recent Economic Changes of the President's

Conference on Unemployment believes, the petroleum industry reflects the impulse of the times to a notable extent.

"For several years past there has existed a condition of overproduction both of crude oil and refined products, including gasoline. The thought in the industry has been directed toward an effort to remedy this situation, with a view to more nearly balancing production and consumption of crude oil and the principal refined products.

"It is now possible to say that the supply of crude oil in the United States, by voluntary action on the part of individual producers in the several states in this country, has been curtailed to approximate equilibrium with current refinery demand. This has been in part fulfillment of the expressed recommendation of the Federal Oil Conservation Board that the industry itself take steps to conserve the petroleum supply.

"The refinery demand for crude oil in 1929, however, has been inflated to the extent that gasoline has been overproduced by approximately 8,000,000 barrels, which gasoline must be liquidated in 1930. It is, therefore, obvious that the current level of refinery demand for crude oil can be maintained only by virtue of further overproduction of gasoline.

"In the petroleum industry a condition of gasoline overproduction is recognized as existing, and is promising to grow more serious and acute if the supply of this commodity is not promptly and substantially curtailed; and the first quarter of 1930 is regarded as a particularly critical period, during which gasoline stocks threaten to mount to uneconomic and unsound levels. Unless the refiners, through education and knowledge of the situation, restrict their production of gasoline to market requirements, the continued conversion of crude oil into gasoline at too rapid a rate would nullify the effects of the curtailment, already accomplished, in the supply of crude oil."

On the following day the directors officially recognized and approved the policy of unitization, recommending it to the industry in this resolution:

"WHEREAS, Unit development and operation of (single) oil pools secures: the maximum ultimate recovery of the oil and gas; the development of the pool at a minimum cost and economical production; the most efficient utilization of the natural gas in the production of the oil and elimination of its waste; and, in general, the conservation of the oil and gas and prevention of waste attendant on overproduction;

"NOW, THEREFORE, BE IT RESOLVED, by the Board of Directors of the American Petroleum Institute: That it endorses

the policy of unitization of oil pools, and recommends it to the industry throughout the United States wherever practicable; and

"BE IT FURTHER RESOLVED, by said board of directors: That in cases where unitization is found to be unattainable or impossible, every effort should be made to effect a cooperative agreement between the parties interested in the potential pool, to insure orderly and economical development and production and the prevention of waste arising from overproduction; and

"BE IT FURTHER RESOLVED: That a standing committee of this board be appointed, charged with the duty of cooperating with committees of other organizations in promoting the general adoption of the unitization practice."

INTERNATIONAL ASPECT OF CONSERVATION

Sir Henri Deterding, head of the Royal Dutch-Shell interests, speaking at the Institute's annual meeting, suggested the establishment of petroleum conservation on a world-wide basis by creation of an "association of cooperation."

The closing weeks of 1929 found conservation policies still effective in the field. On December 12 Oklahoma operators approved the proposal of the Mid Continent Oil and Gas Association to pro-rate production of flush and semi-flush pools during the first quarter of 1930. In a resolution the operators asked foreign operators to adapt their development programs to restriction plans effective in the principal producing areas of the United States. That same day California producers agreed to hold 1930 shipments of gasoline to Gulf and Atlantic ports to within approximately 1,000,000 barrels of the 1929 total.

President Reeser, in a statement to the press, December 22, again commended the conservation policies adopted by the industry, declaring it was generally conceded they had gone far toward stabilization of the industry. Cooperative agreements in the various fields, he said, had resulted in keeping in the ground at least 10,000,000 barrels of oil that otherwise would have been produced.

The success attending conservation efforts in 1929, however, was somewhat dissipated by threats of increased production early in 1930. Some purchasing companies reduced Mid Continent crude oil prices around the middle of January, and a general reduction followed a month later. On January 17, Oklahoma City pool operators voted to curtail production 75 per cent, beginning January 21. Similar curtailment plans became

effective in other pools of Oklahoma and Texas. Kansas swung into line, with an agreement to restrict wells to 25 per cent of capacity for the month beginning February 15.

FURTHER CURTAILMENT PLANNED

Meeting at Tulsa, January 29, the Independent Petroleum Association, formed during the Hoover oil conference in June 1929, to work for a tariff on petroleum imports, decided to appeal to Congress for such a tariff, blaming the surplus of oil on crude brought in from foreign fields. Operators meeting with the Mid Continent Oil and Gas Association at Fort Worth, January 31, organized a Central Committee of Operators to bring about curtailment of production in Texas. The Oklahoma Corporation Commission, on January 27, granted an application for further pro-ration by ordering production held to 25 to 66⅔ per cent of potential in various flush pools. The State of California again sought legal aid to conservation enforcement, and filed suits against 10 operators in the Kettleman Hills field to restrain unreasonable waste of natural gas. Secretary Wilbur discussed further plans for development with the Kettleman Hills operators without reaching an agreement.

President Reeser carried the appeal for conservation to the public in a radio address delivered February 1. "Conservation," he explained, "does not mean hoarding resources for future generations, but rather that the products should be used only for the higher purposes to which they are most readily adapted. We believe that it is an economic waste to produce petroleum in such great quantities that it is forced into competition with low-cost coal for consumption under boilers. We believe that the current production of petroleum should be limited from time to time as the demand for high-class consumption may require. Petroleum is our most rapidly depleting resource. We know not whence it came, nor can we measure the future supply. According to the estimates of the United States Government Geological Survey, we have at this time only 18 per cent of the world's petroleum reserves; actual figures show that the United States is producing 72 per cent of the total consumption of petroleum products in the world. We know that it is being produced at a rate, and in a manner, which encourages economic waste." On February 8 the House Ways and Means Committee heard arguments for a tariff on oil. On March 22 the Senate for a third time defeated a proposal to impose the requested tariff.

Operators in the Yates pool, Texas, on February 6, agreed with the State Railroad Commission to reduce allowable daily

production 30,000 barrels. California oil company executives, meeting at Los Angeles February 10, appealed for public support of the gas conservation law, and declared that production of 600,000 barrels of crude oil daily would meet the demand for 1930. Santa Fe Springs operators agreed to extend the pro-ration plan for that field, which ended February 1, for 90 days, holding production to 70 per cent of potential.

On February 11, at New York, President Reeser appointed a Central Committee on Unit Operation to guide the Institute's work in promoting the unit development and operation of oil pools. William N. Davis, Phillips Petroleum Co., Bartlesville, Okla., was made chairman of the standing committee. Following is the membership:

T. H. Barton	Lion Oil and Refining Co	Eldorado
Amos L. Beaty	Transcontinental Oil Co	New York
E. R. Brown	Magnolia Petroleum Co	Dallas
J. A. Browne	General Petroleum Corp	Los Angeles
Axtell J. Byles	Tide Water Associated Oil Co	New York
Frank R. Coates	Henry L. Doherty and Co	New York
J. S. Cosden	Cosden Oil Co	Fort Worth
Craig F. Cullinan	American Republics Corp	New York
Henry M. Dawes	Pure Oil Co	Chicago
T. A. Dines	Midwest Refining Co	Casper
O. D. Donnell	Ohio Oil Co	Findlay
W. S. Farish	Humble Oil and Refining Co	Houston
W. S. Fitzpatrick	Prairie Oil and Gas Co	Independence
H. V. Foster	Indian Territory Illuminating Oil Co	Bartlesville
Jacob France	Mid Continent Petroleum Co	Tulsa
Wirt Franklin	Wirt Franklin Petroleum Co	Ardmore
C. M. Fuller	Richfield Oil Co	Los Angeles
John L. Gray	Shaffer Oil and Refining Co	Tulsa
M. J. Grogan	Louisiana Oil and Refining Co	Shreveport
R. C. Holmes	The Texas Company	New York
W. M. Irish	Atlantic Refining Co	Philadelphia
K. R. Kingsbury	Standard Oil Co. of California	San Francisco
R. F. MacArthur	Barnsdall Oil Co	Tulsa
R. S. MacMillan	California Oil and Gas Association	Los Angeles
Edgar J. Marston	Texas Pacific Coal and Oil Co	Fort Worth
W. C. McDuffie	Pacific Western Oil Co	Los Angeles
E. T. Moore	Simms Petroleum Co	Dallas
D. J. Moran	Continental Oil Co	Ponca City
J. Edgar Pew	Sun Oil Company	Philadelphia
Waite Phillips	Independent Oil and Gas Co	Tulsa
E. G. Seubert	Standard Oil Co. (Indiana)	Chicago
L. P. St. Clair	Independent Oil Producers Agency	Los Angeles
W. G. Skelly	Skelly Oil Co	Tulsa
Thomas B. Slick	Tom Slick Oil Co	Oklahoma City
W. C. Teagle	Standard Oil Co. (New Jersey)	New York
J. C. Van Eck	Shell Union Oil Co	New York
L. H. Wentz	Wentz Oil Corp	Ponca City
George P. Whaley	Vacuum Oil Co	New York

On February 11 also the Institute formally inaugurated the work of its new Divisions of Production, Refining, and Marketing, organization of which had been approved in a resolution adopted by directors at the annual meeting. A uniform plan of organization and procedure for the divisions, approved by the directors January 9, was designed to provide adequate departmental organization whereby Institute activities relating directly to production, refining, or marketing more generally might be participated in by members, to permit independent consideration of specific problems relating to any branch of the industry, to assure closer relationships between members engaged in similar branches, and to facilitate correlation of Institute activities. The uniform plan provided also for organization of units of the Institute in pools, fields, states, and sections.

During February the legality of the administration policy restricting the issuance of permits for prospecting public lands for oil and gas was argued in District of Columbia supreme court, but decision was reserved pending filing of briefs. The pro-ration program in the Yates pool, Texas, was extended to July 1. Pro-ration was increased to 87½ per cent of potential until April 3 in the Oklahoma City pool. A general curtailment committee, organized in California, began work on a program for statewide reduction of production, based on a fixed schedule for each field. The annual report of the U. S. Bureau of Mines, giving 1929 world oil production as 1,488,604,000 barrels and United States production as 1,006,000,000, both the largest in history, showed that production in the United States declined after August 1929, decreasing steadily during the rest of the year as curtailment programs went into effect.

SUGGEST REFINING CURB

The Federal Oil Conservation Board, on March 4, directed the attention of the refining branch of the petroleum industry to conservation by suggesting that too much gasoline was being produced, and that output might well be reduced by operating refineries on a six-day week basis, in effect lowering production one-seventh. The general committee of the American Petroleum Institute's Division of Refining endorsed the board's suggestion in a resolution adopted March 31, and urged interested individual refining units to conform.

On March 11 Secretary Wilbur, as chairman of the Federal Oil Conservation Board, appointed a Committee on Petroleum Economics to make a complete and unprejudiced analysis of

estimated demand for, and consumption of, petroleum products for 1930. The committee was directed particularly to determine: 1, the anticipated consumption of refined products; and, 2, what amount of crude oil would be necessary efficiently to meet that demand. Two weeks later the committee reported to the board that its survey had shown that a production of 942,800,000 barrels of crude oil, or 1.4 per cent less than the 1929 output, would be required in 1930 to meet an estimated demand for 476,700,000 barrels of gasoline, 456,000,000 barrels of fuel oil; and stated quantities of other petroleum products. The committee explained it had allowed for a draft of 30,100,000 barrels on storage stocks.

Constitutionality of the California gas conservation law was upheld in Los Angeles superior court on March 12 by Judge Hazlett, and on March 19 he granted an order sought by the State of California temporarily restraining Santa Fe Springs field operators from unreasonable waste of natural gas. The injunction represented a victory for the state in the suit filed by certain operators to test the law. The case had been carried to the supreme court by the state after the operators had asked the district court of appeals to decide whether lessors and others could be held necessary parties to the suit. The supreme court, taking the case from the jurisdiction of the appeals court, decided lessors were not necessary parties, and ordered the superior court to proceed.

Under the order operators thus were restrained:

"From blowing, releasing, or permitting any natural gas to escape into the air from any well or wells in the Santa Fe Springs oil field before the removal of the gasoline from such natural gas.

"From operating any well producing natural gas in the Santa Fe Springs oil field, except while exercising a high degree of care in the selection and adjustment of appliances and in the use thereof for the purpose of keeping each producing well in its 'optimum gas-oil ratio'—the term 'optimum gas-oil ratio' being defined as the smallest number of cubic feet of gas which can be produced with each barrel of oil from the same well at the same time.

"From producing more net formation gas on the average day of each seven-day period from any lease or other property unit than is set forth in the 'Allowed Gas Production' column in the schedule."

The restraining order was made effective March 21. Three engineers were appointed a board of adjustment to determine equable pro-ration.

LEGISLATURES AND COURTS ACT

On April 10 crude oil prices were advanced in the Mid Continent fields. On April 14 Supreme Court Justice Bailey, in the District of Columbia, issued writs of mandamus to Secretary Wilbur directing him to reinstate in Department of the Interior files applications for permits to prospect public lands for oil and gas, and thereafter to proceed in accordance with the national leasing act of February 25, 1920. In effect, the decision set aside the administration policy of restricting exploration for oil and gas on public lands, Justice Bailey holding that President Hoover and Secretary Wilbur, while having authority to carry out the intentions of the act, lacked power to suspend its operations. The government appealed the decision.

California supplied conservation news late in April. On April 20 operators in the Santa Fe Springs field voted to continue a voluntary production curtailment program for six months more.

President Reeser, speaking before the semi-annual meeting of the National Petroleum Association at Cleveland, O., April 23, declared that despite the greatest potential production ever known, the industry through cooperative conservation efforts was making possible a balance between production and consumption, and the cooperation of refiners was needed. "The old idea of 'the survival of the fittest' has been pushed aside," he said. "Extreme selfishness and the 'competitors be damned' attitude have been displaced by a wonderful spirit of cooperation throughout nearly all the flush producing fields of the United States. The small producers, and indeed the nation, should appreciate the unselfish efforts on the part of the major companies and the more fortunate smaller concerns. It is an achievement never before reached in the industrial activity of a major industry."

During May curtailment programs were extended in the fields. On May 13 operators in the Santa Fe Springs field, California, agreed to cut production to 57 per cent of potential; but the plan failed to win full cooperation, and three days later crude oil purchase prices again were reduced. On May 29 the state officially ordered all California fields to curtail output one-half. Across the country, in the Bradford-Allegheny fields of Pennsylvania and New York, operators agreed to reduce June production to 80 per cent of April's average output.

OIL BOARD REPORT

The Federal Oil Conservation Board made its fourth report on May 28.* It endorsed unitization as a remedy for overproduction. It urged action by courts or legislatures affirming the co-equal rights of property owners to oil and gas in a given pool as an aid to unit development and operation. It proclaimed as the function of refiners the gaging of composite demand for petroleum products in their respective marketing territories as a guide to their commitments for crude oil. It approved voluntary pro-ration programs in flush fields; and it reaffirmed the need of a practical conservation policy, even though estimates of United States oil reserves have been revised upward.

Crude oil prices in the Santa Fe Springs field of California were restored on June 14. Four days later Superior Court Judge Crawford at San Francisco denied the application of the State of California for a court order restraining operators in the Long Beach field from wasting natural gas. Judge Crawford held the state had failed to prove unreasonable waste. Final hearing in this, as in similar cases instituted by the state, was put over until late in the year.

On June 23 the House public lands committee approved application of the policy of unitization to the development of public lands. The House of Representatives on July 3 passed an administration bill designed to permit the Secretary of the Interior and lessees of government land to enter into unitization or cooperative development agreements with private operators for mutual profit and the elimination of wasteful competition. The bill was signed by President Hoover on July 9, to become law July 31, 1931.

President Reeser, in a statement to the press on June 27, declared that with production and imports of crude oil some 300,000 barrels a day less than a year ago and domestic consumption and exports approximately 100,000 barrels a day larger, the petroleum industry was in an unusually good position. He held it to be the result of the production curtailment movement. Recalling that two years of work were necessary before general success was accomplished in curtailment of crude oil production, President Reeser said that only recently had conservation efforts been made in the refining branch of the industry, and that new difficulties were encountered because refined products are in interstate commerce and no attempt to enter into agreements could be made. Rather, he explained, efforts were under way to educate refiners individually along

* See "Fourth Report, Federal Oil Conservation Board," p. 155.

the line that they have ample facilities to meet demands by operating on a demand basis, and that large stocks of gasoline are not required. "We have stabilized the production of crude oil," he concluded, "and in my opinion refiners will see that stabilization is in their interest too, and their companies individually then will curtail production of refined products."

On June 30 the pro-ration program of Oklahoma was extended three months. New Mexico, whose officials long had resisted attempts to curtail oil production in the state on the ground that output did not meet demand, made conservation history on July 10. An agreement was signed pro-rating the production in the Hobbs field to 25 to 75 per cent of potential through the application for the first time of the first statute of any state authorizing permissive agreements for development and exploitation of oil lands.

Mid-July found conservation practically applied in the major fields. On July 15 operators in Oklahoma agreed to curtail output an additional 25 per cent during July and August, while operators in the Bradford-Allegheny fields announced a five-year conservation program, with immediate curtailment of 30 to 50 per cent of output.

FOURTH REPORT, FEDERAL OIL CONSERVATION BOARD, U. S. DEPARTMENT OF THE INTERIOR, MAY 28, 1930

I. ECONOMICS OF THE PETROLEUM SITUATION

During 1929 all previous records were surpassed in the production of crude petroleum and natural gasoline, in the domestic demand for petroleum products, and in the quantities of oil held in storage. Production of crude petroleum in the United States amounted to 1,006,000,000 barrels, representing a 12 per cent increase over 1928; 1929 was the first year in which production reached the billion mark. Crude oil production in countries other than the United States reached a total of 482,604,000 barrels, or 58,344,000 barrels more than 1928. The rate of increase in domestic production did not quite equal that of foreign oil-producing countries; consequently, the share of the United States production in the world total dropped from 68 per cent in 1928 to 67.6 per cent in 1929.

The refining branch of the industry was not far behind the crude oil producers in record-breaking achievements; it established a new high mark of 987,708,000 barrels of crude oil run to the stills, an increase of 8 per cent over 1928. The indicated domestic demand for all refined products showed a gain of

9 per cent over the previous year, and the consumption of gasoline in the United States was 13 per cent greater than in 1928, and exceeded expectations in this respect. Any benefits to producers which might have accrued from gain in domestic demand were, however, more than offset by the increase in the available supply of raw materials—crude petroleum and natural gasoline. Stocks of both crude petroleum and refined products increased materially, and during one month only (November) was there any reduction of the total stocks of all oils, already large.

In contrast with the situation in 1929, the preceding year witnessed a material improvement in the statistical position of the petroleum industry.

This was due mainly to two factors: first, curtailment of crude production which kept the total for the year from surpassing that of 1927; and, second, the increased demand for refined products, principally gasoline.

An increase of 10 per cent in crude "throughput" at refineries and a 1.4 per cent increase in the relative yield of gasoline were together responsible for a 14 per cent increase in gasoline output. The increase, during the summer of 1928, in the total demand for gasoline considerably exceeded the gain in output, and refinery stocks fell to the equivalent of 22 days' supply. Prices which at the beginning of the year had been at low levels increased materially, and the refining branch of the industry, intent on making the most of this change in its statistical position, increased its crude throughput to new high levels. The increased output of gasoline resulting from the increased runs overlapped the decline in gasoline consumption which marked the approach of the colder seasons. At the same time, another factor was introduced in the prospect of a material gain in crude oil production through large increases at Santa Fe Springs, California, Oklahoma City, Oklahoma, and in various parts of Texas.

At the beginning of 1929, therefore, several disturbing factors were in view, but prices of refined products were well above those of the year previous. The economic programs outlined for the year by the students of the situation were based primarily on the belief that crude oil production should not exceed the 1927 and 1928 totals of 900,000,000 barrels. The expected increase in gasoline consumption was to be met through the stimulation of the refineries to make more than the usual annual increase in gasoline recovery per barrel of crude refined. This program, however, faced the handicap of a material

amount of flush production from wells either just brought in or ready to be completed. Most of these wells were in areas which, because of the character of the leases, were not particularly adaptable to pro-ration or curtailment agreements. Crude oil production mounted higher, and during the summer months reached a daily average but slightly under 3,000,000 barrels. The spirit of cooperation which characterized the year, and the genuine efforts to maintain a balance between crude production and demand for refined products, through pro-ration and curtailment agreements under auspices of state authorities, undoubtedly held underground a large amount of crude oil, and were, in this respect, helpful influences.

The refining of crude petroleum is a manufacturing process, using crude oil as the principal raw material, the general purpose of which is to supply the needs for motor fuel, illuminating oils, distillate fuel oils for domestic heating, gas oils and Diesel oils for land and marine use, residual fuel oils for commercial and industrial heating, and lubricants for automotive and industrial needs. Except for a very limited direct use of heavy crude oil as a fuel or road oil, there is no direct public demand for crude petroleum. The public demand for petroleum is expressed in the composite requirements for refined products.

Thus crude oil demand defines only the quantity of crude oil required by petroleum refiners as the principal raw material in the manufacture of refined products. Such demand may be expressed through crude oil purchasing agencies, but, in such instances, the crude oil purchaser interprets the needs of the refiner and not those of the ultimate consumer of the refined products. The direct demand for petroleum products is expressed through purchase intended for use within the country and through purchases intended for shipment and use abroad. One is domestic demand; the other is foreign demand.

The net result is that, on the one hand, there is the daily production of crude petroleum and natural gasoline—raw materials which fill the needs of the refiner—and, on the other hand, there is the daily composite demand for refinery products. It is the function of the refiner, or manufacturer of petroleum products, to gage this composite demand, as applied to his own marketing territory and, through his interpretation, to be guided in his commitments for the purchase of crude oil.

When the refiners' crude oil purchases are properly coordinated and when the composite public demand for refined products has been correctly interpreted, the crude oil requirements

would be equivalent to total domestic and foreign demand. Under conditions of crude oil supply available at low prices, however, the refiner may increase his crude oil throughput and, concurrently, his output of refined products in excess of the public demand. Crude oil production may have been stimulated at the same time that refinery stocks of refined products were being increased; and, during the period of correction, the condition of overproduction would tend to become general throughout the industry. An unbalanced production is the inevitable result of unwarranted development, whether this be in crude oil production, refining capacity, or in transportation facilities. Increasing capacity for production far in advance of growth in demand leads naturally to overproduction and disorganized markets.

It is only by a correlation of actual demand for petroleum products with the available supply of raw material that a true understanding of the situation may be reached. In but one of the last five years (1926) has domestic demand for petroleum products been in excess of domestic production of crude. The relative trends in the supply of the raw materials of refining and in the demand for refined petroleum products are shown on the accompanying chart, which has been prepared in a manner similar to the chart which accompanied Report I of the Federal Oil Conservation Board. This table shows that the domestic demand for all oils increased 79,000,000 barrels, or 9 per cent, in 1929. This should be regarded as a satisfactory rate of growth, but for the petroleum industry in 1929 it was more than offset by an increase in crude production of 115,000,000 barrels. The difference was reflected principally in stocks, which increased 68,000,000 barrels in 1929, as compared with only 23,000,000 barrels in 1928.

Stocks of all oils have grown rapidly in recent years so that, on December 31, 1929, they amounted to a total of 682,000,000 barrels. Not only does this constitute nearly eight months' supply, but during the early months of 1930 rate of production continued to add to these quantities. In addition to these quantities of oil held in storage above ground, there are controlled wells which have been estimated as capable, if opened to capacity, of increasing present production by one or even three million barrels daily. On the basis of this available supply of oil, and recognizing that methods of procuring and extracting oil have progressed to a point where increased demand through seasonal influences or otherwise may be quickly met, many refiners have adopted the policy of restricting to bare working

stocks the quantities of oil held in storage, in contrast with the former policy of storing quantities of oil in anticipation of an expected shortage. This policy is safe, and results in large savings in the carrying cost of unneeded storage.

In view of recent public statements to the effect that the general oversupply of oil is due primarily to imports and not to domestic production, some further analysis of the figures is opportune. Taken alone, statistics of crude oil production and imports, which make up supply, have little significance since, as stated before, the other or demand side of the balance sheet appears for the most part in refined products, whether for domestic consumption or export. In this manner only can the complete picture of supply and demand in the petroleum industry be presented. The surplus output of our refineries is exported; in 1929 these exports included gasoline in an amount equal to 14 per cent of our total output; kerosene, 34 per cent; and lubricants, 32 per cent. These exports of refinery products were valued at over one-half a billion dollars, and constituted the third largest item in the foreign trade of the United States.

A supply and demand table based on crude oil figures alone would show as domestic demand the requirements of the domestic refineries; but if our foreign trade in refined products were to cease entirely, the refinery demand for crude would have to fall at least an amount representing the exports of gasoline, and there would still be an embarrassing overproduction of kerosene, lubricating oil, and wax. In other words, between 10 and 15 per cent of the crude produced and run to refineries is represented on the consumption side of the balance sheet by refined products for foreign markets. To that extent, the consumption of crude oil by domestic refineries represents other than "domestic demand."

The statistical and graphical presentation of the facts of production and consumption affords conclusive proof of the lack of balance between the oil and natural gasoline output of the wells of the United States and the domestic demand for the refined products. In ten out of twelve years there have been additions to the quantity of crude and refined products in storage; since 1922, total exports for each year have exceeded total imports; and in none of the last five years have imports of crude reached 9 per cent of domestic production.

These relations demonstrate the fact of overproduction of crude oil in the United States in 1929, as in most other recent years.

II. REVISION OF ESTIMATES OF OIL SUPPLY

The discovery of new fields and of deeper sands in oil fields makes necessary some revision of our ideas regarding the supply of oil available to meet future demands. During the last decade every estimate that had been made of recoverable oil remaining in underground storage has required revision in the light of later increased production factors. The production since the beginning of 1925 has approached the amount of reserves in proved acreage as estimated at that time; and, in the light of experience, most earlier estimates similarly are seen to have been far too conservative. The geologist, with the aid of the production engineer, seems to have proved his own estimates wrong. However, as pointed out in the first report of the Federal Oil Conservation Board, oil is an irreplaceable natural product, and the oil resources of the country are limited. Increased production is not an index of the remaining resources, but a record of depletion and a warning of impaired reserves. To provide for the common defense and promote the general welfare, the government and industry must cooperate to protect the newly discovered oil reserves and those previously known from dangerous and too rapid depletion.

The changed views of the extent of our underground oil reserves show increased potential recoverable totals, and thus indicate a later date of ultimate depletion. Several factors have created these more favorable conceptions of the situation: 1, new and more accurate methods of geological exploration; 2, the discovery of deeper prolific sands; 3, improved operating methods; and 4, the rejuvenation of partially depleted fields.

The application of geophysical prospecting methods to the problems of applied oil field geology has greatly improved the technique of determining the location, shape, and extent of structures favorable for the accumulation of oil. By the use of methods such as the gravimetric, the magnetic, the seismic, and the electric, many of the hazards of " wildcat " exploration are eliminated, and the oil drill may be started with more definite assurance of commercial production.

Deep drilling has resulted in the discovery of prolific horizons at depths which a few years ago were unattainable. Then the drilling of a well to a depth of 5,000 feet was considered an outstanding accomplishment, fraught with extreme difficulty and hazard; to-day most of the problems involved in reaching a depth of 10,000 feet have been solved.

Deep drilling has resulted in radical changes in specifications for drill pipe and casing, and has called for improved engineering methods. Extensive research has produced equipment of satisfactory design and strength to meet these increased demands. The use of steel with special physical properties and the employment of new forms of joints have made possible casing to a greater depth.

To cope with the high temperatures and pressures encountered in the drilling and finishing of deep wells, special study of circulating fluids and cements has been made. Results of technical research in progress indicate that satisfactory circulating fluids which will not froth or otherwise become unsuited for rotary drilling, and cements setting satisfactorily at high temperatures, will soon be available for use in deep wells subject to excessive temperatures.

The improvement in operating technique is constantly increasing the percentage of recovery of oil from the sand, and a new interest has developed in some of the older fields, from which appreciable supplies of oil are now being recovered as a result of rejuvenation. This means harvesting a second crop of oil, and in the Bradford and Alleghany fields of Pennsylvania alone new methods are estimated to have added 600,000,000 barrels to the ultimate recoverable supply.

Better technique in drilling and completing wells, the rational development of pools without competitive drilling, the maintenance of gas pressure in the new fields, and the restoration of pressure in partly depleted fields are all factors of outstanding importance in increasing the total production of crude oil from the natural reservoirs of this country. This increase in ultimate recovery from fields in excess of the original estimates—which in specific terms referred to the oil "recoverable by the production methods then in use"—together with the discovery of deep prolific sands and new fields, explains the inconsistencies between previously estimated reserves and the enormous quantity of oil produced subsequent to the making of such estimates.

Such revision of estimates does not increase the actual future supply. Expressing these estimates of reserve in years, moreover, introduces into the equation another unknown factor, the rate of consumption, which has not lagged far behind the almost incredible increases in the rate of production. Yet what the consuming public asks is: How long can supply keep pace with demand?

At present the large margin of safety between domestic demand and supply calls for a considerable degree of restraint

in producing from newly discovered fields and sands. Never before has there been so large a shut-in production. Many well-informed men in the industry believe that if all the wells of California, Texas, and Oklahoma were opened to full capacity, the present daily output, large as it is, might be temporarily doubled. This potential production of oil wisely held in underground storage represents a quick asset that will be immediately available when needed.

The purpose of the several conservation measures urged by the Federal Oil Conservation Board is primarily to delay the coming of the day when an impending shortage of crude oil will cause a radical advance in the prices of the refinery products the public buys. It matters not whether the oil reserves of the United States are five times a billion barrels or twenty times a billion barrels, the supply is limited and cannot be increased. Even the most generous estimates place the date at which our oil reserves will be practically depleted, under present rates of consumption, in the comparatively near future. In the interests of national defense and industrial prosperity, this generation should not be permitted to waste this irreplaceable natural product and thus seriously handicap future generations of Americans.

III. ECONOMICS OF NATURAL GAS DISTRIBUTION

Recent development in long-distance transportation of natural gas constitutes one of the most noteworthy achievements in modern economic history. Major industrial areas, hitherto dependent upon solid or liquid fuels, have been brought within the range of natural gas service through the construction of pipe lines covering distances which, until recently, were considered beyond the limits of immediate possibility.

Recognition of the merits of natural gas as an ashless fuel of high heat value, definite conclusions as to the adequacy of its supply, and surveys of potential demand in areas under consideration, were combined with the engineering ability and financial support necessary for these new accomplishments in transportation. Much of this construction has been so recently completed that its full effect is not yet apparent.

During 1928 more than 1 trillion 568 billion cubic feet of natural gas was produced and delivered to consumers, an increase of 8 per cent over corresponding figures for 1927. Of the 1928 distribution, 36.6 per cent was consumed as a fuel in oil field operations and 7.3 per cent for fuel needs at petroleum refineries, making a total of nearly 44 per cent consumed within

the oil industry. Manufacturing and industrial plants utilized 19.5 per cent of the total, 4.9 per cent was consumed in the generation of electric power at public utility plants, and 11.2 per cent was used in the manufacture of carbon black. A total of 79.5 per cent was used in industry, and 20.5 per cent for domestic purposes.

The quantity of natural gas produced and delivered to consumers during 1929 reached a total of approximately 1 trillion 800 billion cubic feet, an increase of about 15 per cent over 1928. Natural gas production in Louisiana, the point of origin for several of the longer interstate lines completed during this past year, increased nearly 30 billion cubic feet, or approximately 13 per cent, over 1928. Withdrawals of natural gas from high-pressure wells in Texas during 1929 were approximately 18 per cent greater than in 1928. Increased production was reported also for Oklahoma, and in California the 1929 natural gas production was substantially greater than during the preceding year.

Although sufficient information is not yet available to determine all trends in consumption, some tendencies are apparent. The consumption of natural gas as a fuel in the generation of electric power at public utility plants reached a total of 112,847,040,000 cubic feet, as compared with 77,173,517,000 cubic feet during 1928, an increase of 46 per cent. Purchases of natural gas for distribution by 98 public utility gas companies during 1929 were 49.7 per cent greater than in 1928. Preliminary data from trade sources indicate that the production of carbon black during 1929 was approximately 45 per cent more than in 1928, from which it may be inferred that the natural gas consumption in the manufacture of carbon black increased proportionately. This increased carbon black production was largely confined to Texas. Preliminary information from state sources indicates that 200 billion cubic feet of residue gas were used in carbon black manufacture in Texas during 1929, as compared with approximately 63 billion during 1928.

The number of communities in Texas served with natural gas has increased from 82 at the close of 1926 to 490 at the end of 1929. In Oklahoma, 285 cities and towns were receiving natural gas service at the close of 1929, as compared with 254 at the beginning of the year. The pipe line from Wyoming to Ogden and Salt Lake City added 13 communities in Utah to those served with natural gas. It is reported that 20 cities and towns in Arkansas and Missouri were included in the natural gas service afforded by the pipe line completed from northern

Louisiana to the St. Louis industrial district. The recently completed pipe line from Louisiana across Mississippi, Alabama, and Georgia is planned to serve 40 communities in these three states.

Prior to 1927 transportation of natural gas over a distance of 250 miles was regarded as an outstanding engineering accomplishment. In July 1927 a line 20 inches in diameter was started at Pampa, Gray County, Texas, to connect the gas fields of the Texas Panhandle with Kansas City, Mo. The whole system, when completed in September 1928 was 382 miles in length, and was estimated to be capable of handling a maximum peak-load delivery of 250 million cubic feet daily. In December 1927 another long natural gas transmission line was started. This line, 22 inches in diameter, was laid from the Amarillo field, in the Texas Panhandle, to Denver, Colo., a distance of 340 miles, and was referred to as one of the greatest enterprises undertaken in the gas industry. During 1929 this system was extended eastward from Pueblo to several towns within a distance of approximately 50 miles, and plans are reported under consideration to extend it to other communities nearer the Kansas line.

The completion of these lines was followed closely by other developments. Some major pipe line projects recently completed are:

1. Memphis has been supplied with natural gas from Louisiana since December 28, 1928.
2. New Orleans is served with natural gas through an extension of the pipe line which formerly terminated at Baton Rouge.
3. The St. Louis industrial district is supplied with natural gas through a 450-mile pipe line from Louisiana.
4. A 420-mile pipe line has been built across Mississippi, Alabama, and Georgia to deliver natural gas from Louisiana to Birmingham, Ala., Atlanta, Ga., and other communities in these states.
5. A 250-mile pipe line has been laid to San Francisco from the Buttonwillow and Kettleman Hills areas in southern California, and is being paralleled by a second line.
6. Salt Lake City and Ogden, Utah, are served with natural gas from Baxter Basin, Hiawatha, and Clay Basin fields in Colorado, Wyoming, and Utah.
7. Monterey, Mexico, is served with natural gas from the Jennings field, Texas, through a pipe line crossing the international border at Roma, Tex.

8. Approximately 200 miles of pipe line carry natural gas from the Jal area, Lea County, New Mex., to El Paso, Tex.

Projects under recent consideration, tending to extend areas served with natural gas, although actual construction has not been started, include a 950-mile pipe line from the Amarillo field, in Texas, to Chicago; the extension of the present pipe line to San Francisco northwards to Oregon and Washington; the extension of the pipe line system in the Rocky Mountain district to include Butte, Anaconda, and other communities; the conversion of oil pipe lines to the transport of natural gas and the construction of necessary additions to serve mixed gas to certain cities along the Atlantic seaboard.

Reviewing this list of natural gas lines and anticipating the building of still longer lines, the question naturally arises as to what new conditions have made possible the building of natural gas distributing systems extending farther and farther from the gas fields.

The subject is one in which both engineering and economic factors are involved. Every natural gas distribution project requires the detailed consideration of at least three major factors, namely:

1. Assured supplies of gas for long-time periods.
2. Assured markets.
3. Costs of construction and operation.

Insofar as the decision to undertake a natural gas distribution project is concerned, the first two items have relatively more weight than the third. In other words, cheaper pipe line construction, made possible by the use of improved methods and the application of advanced engineering science, is only one of several items in establishing the first cost of the project; it is essential to have an assured gas reserve, capable of supplying a market over a long-time period, in order to attract the necessary capital to finance the project.

Many long natural gas transmission lines probably would have been built to connect newly discovered fields with marketing centers even with higher construction costs, for the size and nature of the markets and the extended life of proved reserves would assure the amortization of investment in a connecting pipe line long before the natural reservoirs were depleted. Improved methods of pipe line construction have decreased the cost of the long gas lines built during the past several years. The use of large-diameter pipe made of high-carbon steel with greater ultimate strength, and the handling

of gas at high pressures, are developments of outstanding importance in long-distance transmission.

With the advent of conditions requiring a pipe line to deliver maximum peak-load of or exceeding 250 million cubic feet per day, the important problem of design of a natural gas pipe line project includes the study of:

1. Size and weight of line and working pressures.
2. The number and size of compressor stations, together with the desirable compression ratios.
3. Relationship between investment and operating costs with the view of obtaining a properly balanced and economical system.

The principal item of cost in a pipe line project is the cost of the pipe itself. The cost of the pipe varies directly as the weight, which in turn varies directly as the diameter multiplied by the thickness. With increasing diameter, the thickness of the pipe must be increased proportionately to withstand the same pressure. Because an increase in the diameter of pipe increases the capacity more rapidly than the corresponding increase in cost, the general tendency has been to use pipe of sufficiently large diameter to deliver the capacity required at pressure up to 350 or 400 pounds per square inch. However, the possible economy which may be effected in gas transportation through lines of smaller diameters and greater wall thickness under pressures as high as 1,500 pounds per square inch is being considered at the present time. It has been suggested that while the costs per lineal foot of line may be more for this type of construction, the cost per cubic foot of natural gas delivered may be less.

Several gas companies have reduced the cost of their pipe line construction materially by using so-called telescope lines. These lines are made up of sections of pipe of different diameters, the diameter increasing in the direction of flow, as the pressure decreases. For example, where a 16-inch line is required, its equivalent may be built with 14, 16 and 18-inch pipe; or a line of uniform diameter may be built with the weight of pipe decreasing in the direction of flow, so that pipe with thinner walls is used where the pressures are lower. Telescopic design of pipe lines has the effect of reducing the total weight of the pipe and consequently the cost. Telescopic lines should be especially economical where high initial pressures exist and where there are long distances between compressor stations. The efficiency of flow through telescopic lines is being studied by federal and industrial agencies to deter-

mine the advantage in amount of gas handled in these lines as compared with lines of constant diameter.

The increasing use of better welding methods is changing the type of pipe line construction and effecting economies. In the manufacture of pipe, automatically controlled process welding by the electric arc method has made it possible to fulfill some of the requirements of high pressure pipe design. Extensive use of oxy-acetylene welding in the field has marked the passing of large, heavy, cast-iron fittings. The all-welded and forged-steel flanged manifold is a good example of the improvement that has come about through the use of welding in place of cast-iron fittings.

Further economies in pipe line construction have resulted from the use of longer lengths of pipe for main trunk line work. With the generally accepted use of welding on trunk lines, the demand for 40-foot lengths of plain-end pipe has increased. Forty-foot lengths effect a considerable saving in construction costs, and the trend is definitely toward the use of 40-foot lengths, or possibly longer, for welded trunk lines.

Only recently electric arc welding has come into use for the welding of pipe lines in the field. Advocates of the electric arc method believe that it will reduce construction costs and have other advantages. Progress is being made in the development of automatic welding processes for field service. When perfected, these methods will tend to reduce the cost and increase the rate of construction.

Machinery has largely replaced the older hand methods of pipe line construction. Costs have been lowered by laying, hauling, hoisting, and handling pipe with machines and tractors especially designed for this work.

Corrosion is an important factor in determining the cost of a pipe line. The amount of expenditure warranted for protective pipe coatings depends upon the nature of the soil in which the pipe is to be laid and the relative corrosive effects of the soil. The economic value of good pipe coatings has become more and more appreciated during the past few years. Many operators are using costly pipe coatings, and experience has proved that such protections are economically justified. Frequently the life of a pipe line in the ground may be prolonged 50 per cent by the application of proper pipe coating.

Until a few years ago little or no attention was given to the economy possible with a gas-tight transmission system. Now pipe lines are given careful leakage tests. Also, provision is

made for the removal of condensates, sands, and other foreign material which would decrease the capacity of lines and thus increase the compression costs.

IV. NEED OF FULL UTILIZATION OF GAS

The expansion of facilities for distributing natural gas has demonstrated the public demand for this best of fuels. By virtue of its convenience as a domestic fuel and its economy as an industrial fuel, natural gas is winning recognition in communities and districts where it had been unobtainable until technical skill combined with courage on the part of the public utilities made its wide distribution a reality. With this increased and growing market for natural gas, not only the gas produced from the so-called dry-gas reservoirs is in demand, but there is a growing realization of the commercial value of the gas delivered to the surface in conjunction with the production of oil. There has also been a widespread realization of the importance of natural gas in its function as a propulsive agent in the production of oil. So it is that natural gas is now coming into its own as an item of large significance in the balance sheet of the oil operator.

The oil industry now sees substantial profits in this fuel of high heating value which was previously disregarded. Attention had been repeatedly called to the enormous waste involved in the escape of gas to the air, but since above ground storage of natural gas is plainly impracticable from the standpoint of cost, many executives, who thought in terms of oil, regarded escaping gas as unavoidable waste. Now that this natural resource, produced with the oil, has taken on a commodity value at the well, as a result of long-distance pipe lines, opinions and policies have changed. Moreover, production engineers are now pointing out the even greater importance of gas as the most efficient agent in extracting oil from the ground, with the result that it is realized that the prevention of the escape of gas is highly desirable in the practical business of producing oil.

Yet the volume of gas that escapes into the air is not commonly appreciated by many owners or operators, or, if realized, the large quantities thus lost frequently are taken as indicative of inexhaustible reserves rather than of wasted wealth. The latest legislative effort to prevent this waste is the California gas law, which has been described as based on good technology and good economics. As reported by the Gas Administrator of that state, the amount of natural gas blown to the air during the latter part of 1929 was nearly a billion feet

a day, or more than was being used in the entire state; and in some individual oil fields the ratio of waste to use is even now much worse. Nor is California the only state in which the waste of gas is expressed by large figures.

The economic arguments for stopping this waste and enforcing full utilization relate to present profits of the producers and future benefits of the consumers. In the Kettleman Hills oil field in California the gas from the few wells now producing, even without including its gasoline content, is worth more, at present field prices, than the high-grade oil this gas brings to the surface. Yet with the traditions of the industry influencing current thought, the output of oil is the chief consideration; and while earnest efforts are being made at Kettleman Hills to hold back oil production to the requirements of market demand, too little thought is given to the state's contention that "the blowing, release or escape of natural gas into the air shall be *prima facie* evidence of unreasonable waste." Nor is there seemingly any recognition of the obvious fact that for the more than 350 million feet of gas now escaping daily, because less than 20 per cent of the present flow from this source can be marketed, the operators and owners receive no return now or at any time. Gas with a value, at the well, of millions of dollars a year is being blown into the air, an invisible but actual leak.

This blindness to the immensity of the present waste can perhaps be cleared up by a simple analysis of the statement of the California Gas Administrator referred to above. If from July to October in 1929 the amount of blown gas in California actually exceeded the amount utilized, it must follow that at some time in the future the industrial and domestic users of gas will be without gas four months sooner, at the present rate of consumption, than would be the case if this four months' supply had not gone to waste. On the public side, therefore, there is this definite and quantitative relation between waste now and shortage in the future.

V. PROGRESS IN UNIT OPERATION

In his letter dated December 19, 1924, constituting the Federal Oil Conservation Board, President Coolidge laid emphasis on the impossibility of conserving "oil in the ground under our present leasing and royalty practices if a neighboring owner or lessee desires to gain possession of his deposits," and urged "that government and business can well join forces to work out this problem of practical conservation," that cannot be solved by "the simple working of the law of supply and demand."

In its first report, dated September 6, 1926, the board stressed the responsibility that rests upon the oil industry in adopting measures to protect our future supplies, and urged the acceptance of "cooperative methods in sane development of new fields to prevent wasteful flush flow and overproduction." The test of experience was applied to the voluntary agreement plan of pool development and operation by citing actual instances where conservation and economy had been promoted with much success thereby. Nearly four years have elapsed since the publication of the board's first report, and much progress has since been made by the industry along the lines of control of the flush flow. There is much more to be accomplished, however, and the board desires to direct its further efforts at this time along lines that will be helpful in stimulating discussion and in accelerating the crystallization of opinion, both in and out of the oil industry, that will lead to constructive action and will receive general approval, even though in so doing the board may be accused of taking a step in advance of the times and one that is too difficult of accomplishment.

Of the various cooperative methods that have been discussed and have been tried out, the "unit operation" plan seems by common consent to have commended itself more than any other.

Mere mention of united action or cooperative effort suggests to many the idea of monopolistic control. An engineering plan to lower production costs is thought to be the first move in a conspiracy to raise market prices. An effort to reduce waste and conserve supply is interpreted as a scheme to corner the market.

The natural unit in oil deposits is the single pool, large or small; and unit operation is in essence nothing more or less than accepting nature's decree and seeking to work in harmony with it. Unit operation is purely an engineering matter and a local matter, because commonly an oil pool is a relatively small production unit in the country's oil business. Thus, local cooperation in the orderly exploitation of an oil pool is not even a step toward a country-wide merger for the purpose of monopoly. There need be no fear that this observance of natural and economic law involves any violation of statutory law.

The Federal Oil Conservation Board in its first report discussed at some length the question of the legality of cooperative agreements, and said: "The voluntary cooperation proposed would need to include the landowners and operators in a single field or pool, which is a relatively small unit of production, so that the possibility of monopolistic control need not be feared."

As a matter of fact, the same report shows that community action in the handling of what is by right the common property in an oil pool is not different in effect from the operation of a field under single ownership where an economical drilling program is adopted with the definite purpose of high recovery at low cost and at a rate adjusted to market demand.

Overproduction of any commodity is uneconomic; and if it involves depletion of a supply that cannot be replaced, overproduction and the consequent wastefulness effect a permanent injury. Especially is overproduction in the oil business a public menace, by reason of the unnatural and unfair competition between co-owners within the same natural unit. It is this individualistic strife, characterized by haste and waste, that has been a large factor in inciting overproduction in the past.

The change from the delirium of competitive operation of a pool to the sanity of cooperation need not involve any danger that underproduction will be substituted for excess production; going to that improbable extreme can be avoided by the exercise of the police power of the state, as long as there are in the ground reserves of oil large enough to meet an increasing demand. The inevitable day of deficit in supply, with attendant high prices, will be postponed by simply stopping the present type of unnatural warfare, politely termed competition, between neighbors in the same pool.

The cooperation implied in the unit operation plan thus makes for more rational production than the present uneconomic drilling and pumping, but this cooperation within the pool does not preclude competition between pools or fields. The community of interest and action involved in unit operation stops at the natural boundary of the oil pool.

The country-wide influence of such local cooperation upon either supply or price is not one to be overlooked. Even if the idea of consulting economic conditions and coordinating the development and operation of a single pool to the market needs for oil and gas should spread, such economic sanity would not involve public injury or any impairment of public control. Combination between local units would still be just as actionable as combinations between major companies are now, if the purpose should be to restrain production below market needs. Unit operation is not of itself monopolistic control, nor even a step in that direction.

The unit idea in producing oil is bound to win out, because the natural unit is the oil pool. Man may draw property lines on the surface, making a checkerboard for title-searchers and

lease-lawyers to play on, but nature has fixed a boundary line around the underground deposit for geologists to discover and engineers to use in the development of the hidden resource. The unit operation plan is a "back to nature" movement. Codes of laws and judicial decisions relating to oil deposits have accorded to the surface checkerboard a sanctity quite beyond its deserts, while the facts of nature as now known have received little attention and have commanded less respect.

Fences, walls, and other land lines serve effectively as property boundaries where the property is fixed in character and position, whether it is valuable as tillable soil or as a structural foundation. These same lines may be extended downward as vertical planes and serve no less acceptably to define property rights in the ores we mine. The essential part of the property-line idea is our faith in the continuing relation of the line to the fixed property. It serves best of all when by triangulation we tie our private land corners to the geodetic constants; then the hand of man cannot erase beyond recovery the boundaries of our estate. Quite different, however, is the relation of any land lines to property rights in the winds that blow and the waters that flow across these man-marked boundaries. The mobile and fugitive nature of air and water makes our rights to their possession and use related to the rights of our neighbors, so that some coordination is required, lest the use by one interfere with that by others.

All this is recognized in the common law, and is so obvious that it seems strange that a different mode of thought and jurisprudence has prevailed regarding the oil and gas beneath the surface. These substances, like air and water when unconfined, are mobile and fugitive. The legal pronouncement as to oil and gas that possession is ten points of the law puts such property into a unique category. This class of property plainly should be dealt with differently from coal and ore. The geologic facts and natural laws bearing on the conditions of occurrence of oil and gas in their original habitat, that we have learned as the years have passed, render wholly unnecessary their relegation to the "wild animal" class. Whatever the eventful story of its origin and accumulation, the oil as we find it in the oil pools of today is not now fugitive except where it has been disturbed by acts of man. In the undrilled area, the oil under a 50-acre tract is the same oil that was there when the land was surveyed, and indeed when Columbus discovered this continent; long before that historic event the boundaries of undiscovered oil pools were fixed by nature and will change little, if any, as the centuries pass.

Thus, at the moment when the first drill penetrates the oil sand, the amount of oil underlying the holdings of the different landowners within the natural boundary of a pool is fixed and definite, although not then known. The equity of each individual landowner would seem to be no less fixed and definite—a reality related to and varying with area and position of his land, thickness and porosity of oil sand, pressure of the gas associated with the oil, and similar physical facts—undetermined in large part but still determinable. Up to this stage, the oil is a definite and fixed property; and, so far as man-made rights control, that property goes with the surface holdings the possession of which is so carefully protected by the laws of the lands. Participation in ownership of the oil should be limited by the natural boundary of the pool—a property line which is not commonly visible on the surface, even to a geologist, but which with other geological facts can be, and usually is, determined in the course of exploration of the pool. The pool is the natural unit of property ownership in oil.

Within this natural unit, once a beginning is made in bringing the oil to the surface and thus giving value to the underground resource, the oil beneath the surface becomes movable property, and the only boundaries to be considered are the exterior limits of the pool. Thereupon the division of the oil property between the surface owners is no longer fixed—hence the " feræ naturæ " figure of speech of the lawyers. But anyone who sees the oil pool as a natural unit with divided ownership might reasonably ask: Why not adopt a procedure that will preserve rather than destroy pre-existing property rights? Why sanction practices and formulate rules that lead directly to a contest for possession among the owners, each trying to get more than his share of the whole property? By reason of its loss of fixed character, why should not the oil be regarded as taking on the nature of common property? At least this would be substituting equity for war, business in the open for underground robbery.

The violence that the existing procedure, though legally sanctioned, does to the principles of logic and equity is realized when we contrast the rules of the game above ground and below ground. In an oil field the owner of a gusher well, whose good fortune may have caught him unawares without storage tanks, is legally liable for even temporary damages to the surface property of his neighbors if his oil happens to flow over their land; but when has an injunction been granted against the owner of a town lot well the flow of which must by

the nature of things be doing permanent damage to the underground property of his neighbors? Apparently this appropriation of another's property is countenanced simply because it is under cover of the darkness of the depths and has been quite beyond the vision of those who have made our laws and dealt out justice.

Of more recent date than the general understanding of this underground movement of oil after drilling has started is the tardy realization of the function that gas plays in winning oil for the use of man. The natural gas associated with the oil in the pool largely determines its mobility and controls its movement to the well and to the surface. Deplete this gas supply and reduce the pressure, and the recovery of some part of the oil content of the pool becomes more difficult or even impossible, and to that extent the other owners are deprived of what is rightfully theirs. The Saratoga gas case seems to have established this principle for carbon dioxide and water, and might logically be extended to natural gas and oil. As quoted by Mr. Hughes, the present Chief Justice, when speaking before the Federal Oil Conservation Board in 1926, the United States Supreme Court upheld the state statute cited in this case, " forbidding a landowner engaged in collecting and vending as a separate commodity the carbonic acid gas contained in natural mineral waters existing in a common underground reservoir from pumping or otherwise artificially drawing, by means of wells on his property, unnatural quantities of such waters from the common source of supply and wasting them to the injury or impairment of the rights of other proprietors."

The waste of natural gas by any one landowner surely brings about impairment of the common right of adjoining owners to reduce to possession their respective shares of oil and gas in the same pool through wells drilled on their lands; and this common right, as stated by the Federal Oil Conservation Board, " should involve some recognition of correlated obligations, so that in the drawing of oil and gas by one owner from the common reservoir the producer should be required to recognize the right of the neighbor to so much of the oil as is withdrawn from underneath his property, less a reasonable allowance for the cost of production, the hazard of the undertaking, and a reasonable profit on the undertaking."

What is needed now to effect this conservation movement is specific recognition by the courts of this community of interest by all the landowners in the content of the oil and gas pool, in the oil and gas as separate marketable commodities, and in the

energy in the gas—the pressure so easily dissipated but so essential to an adequate recovery of the oil included in the minute pores of the sand or sandstone that forms the reservoir. It is this loss of pressure, which profits no one and damages all, that takes on the character of a legal nuisance, against which owners in the common reservoir should be protected. Impairment or loss of the natural agency that controls the " reduction to possession " of the oil beneath the surface proprietor's land is in effect taking his property.

Forty years ago when the Pennsylvania court decision was rendered, the oil business was only a thirtieth of its present size; today, with a better understanding of geologic conditions, unit operation of an oil pool would seem to be simply following nature's lead. Its economic purpose is to prevent injury to any of the landowners who have similar property rights and to prevent the waste of valuable commodities in which the public as a whole has an interest. The efficiency of this method of treating an oil pool as a unit is now generally endorsed by the production engineers who have studied the physics of the oil and gas in their underground association. The method meets the real test of efficiency by lowering costs of development and operation and increasing the percentage of recovery of oil. The difficulty in putting the plan into effect lies in the large advantage that a single owner of a small surface holding may now seize for himself under the rules of the game as at present supported by well-aged judicial opinion. Repeatedly, proposals for agreements between property owners to promote the efficient and economical handling of their common property, in protection of their mutual rights, have been vetoed by a small minority of the parties in interest. For these reasons, the Federal Oil Conservation Board early urged " the formulation and adoption of remedial measures permitting a better correlation of underground property rights."

Some affirmative action by either court or legislature, whereby the co-equal rights of all the owners may be recognized and protected, is sorely needed, and this regulatory action may well be predicated on the magnitude and gravity of the public interest involved. The principle of justice between owners would seem to be incentive enough, but if more grounds for action are required, good technology and good economics amply justify the acceptance of unit operation as in the public interest. Now that natural gas has taken on country-wide popularity as the best of all fuels, and is recognized as even more valuable and essential in the prevention of actual waste of oil,

through non-recovery, the act of permitting unused gas to escape calls for the prompt exercise of the police power of the state. Any method in the development and operation of oil pools that is more efficient than that encouraged, if not required, under the old competitive system of getting the other fellow's oil first, should not only be accepted but be approved under authority of law. Unit operation is that more efficient method.

That both public and private interest need to be protected from present methods is forcibly shown by the recent record of two wells in California, which have already turned into the pipe lines nearly five million dollars' worth of oil and gas, but from which gas and gasoline vapor worth more than ten million dollars have gone up into the air—a total loss to present and future citizens of that state. Aside from the fact that these two wells happen to be on federal leases, the interest of the general public in the wasted fuels is far too large to be overlooked. It is to prevent more losses of that magnitude that the idea of self-regulation by voluntary cooperative action is winning increasing support within the industry.

Self-regulation in the handling of an oil pool means both efficiency in development and operation and the determination of equities among the owners, and this can best be accomplished by unit operation. By this plan only can each and every owner secure full economic benefits. By this plan only can the public be assured of the largest possible supply of oil and gas from a particular field, won from the ground at lowest cost, and over a period measured by market demand rather than fixed by individualistic greed.

Justice to all owners and benefit to the public can both result from this observance of natural and economic law in recognizing the oil pool as the natural unit.

RESEARCH IN PETROLEUM

RESEARCH FUND

The work of research in petroleum is financed through a fund for scientific research in petroleum geology, physics, and chemistry established by John D. Rockefeller on November 15, 1925, under the auspices of the American Petroleum Institute. (See "Petroleum Facts and Figures," first edition, p. 234.) Commencing with 1926, annual installments of $50,000 each were made available from the $250,000 fund. An additional $250,000, similarly payable in $50,000 annual installments beginning 1926, was made available to the Institute by the Universal Oil Products Co., of Chicago, in furtherance of the same program.

The present trustees of the Rockefeller fund are: W. C. Teagle, president of the Standard Oil Co., of New Jersey; K. R. Kingsbury, president of the Standard Oil Co. of California; and W. R. Boyd, Jr., executive vice president of the American Petroleum Institute.

The American Petroleum Institute has a Committee on Research with these members: W. C. Teagle; K. R. Kingsbury; Henry L. Doherty, president of H. L. Doherty and Co.; J. Howard Pew, president of the Sun Oil Co.; Henry M. Dawes, president of The Pure Oil Co.; H. R. Gallagher, vice president of the Shell Oil Co.; W. M. Irish, president of The Atlantic Refining Co.; W. E. Pratt, director of the Humble Oil and Refining Co., and W. R. Boyd, Jr.

The Institute has enlisted the assistance of the National Research Council, which fosters, encourages, and coordinates cooperative research. The council has established a Central Petroleum Committee, with members from the three interested divisions of the council and from the Institute, to cooperate in the Institute's research program. The members are:

Division of Physical Science: L. H. Adams, Geophysical Laboratory, Carnegie Institution of Washington; Hugh S. Taylor, Professor of Physical Chemistry, Princeton University; R. A. Millikan, Director of the Norman Bridge Laboratory of Physics, California Institute of Technology.

Division of Chemistry and Chemical Technology: Marston T. Bogert, Professor of Chemistry, Columbia University; E. R.

Weidlein, director of Mellon Institute of Industrial Research; Frank C. Whitmore, dean, School of Chemistry and Physics, The Pennsylvania State College.

Division of Geology and Geography: E. L. DeGoyler, president, Amerada Petroleum Corp., New York; K. C. Heald, geologist, Gulf Oil Companies; and David White, principal geologist, U. S. Geological Survey.

Representing the American Petroleum Institute: W. R. Boyd, Jr.; R. P. Anderson, technologist; and Van. H. Manning, former research director.

Under the present plan of procedure, qualified scientific personnel and existing laboratory equipment in universities, technical institutions, and government bureaus are utilized in conducting the research program. Projects are considered by the Central Petroleum Committee and recommended to the Institute, which selects those to be supported.

RESEARCH PROJECTS

Twenty-one projects of research in petroleum now are under way in various institutions (during the period July 1, 1930 to June 30, 1931). They follow:

Project No.	Subject	Locale
1.	Generation of Oil in Rocks by Shearing Pressures	University of Wisconsin
2.	Action of Oxygen (and Air) on Cyclopentane and Cyclohexane Hydrocarbons with Side Chains	University of Brussels
3.	Studies of Source Rocks in the Micro-Furnace	U. S. Geological Survey
4.	Origin and Environment of Source Sediments Present in Petroleum	Princeton University
6.	The Separation, Identification, and Determination of the Chemical Constituents of Commercial Petroleum Fractions	U. S. Bureau of Standards
7.	Catalytic Methods Applied to Petroleum Hydrocarbons	Princeton University
8.	The Effect of Electrical Discharge Upon Gaseous Hydrocarbons	University of Minnesota
18.	Non-catalytic Thermal Decomposition of Pure Hydrocarbons and Related Compounds	Northwestern University
19.	A Study of the Relative Rates of Reaction of the Olefins	Massachusetts Institute of Technology
20.	Isolation and Investigation of Nitrogen Compounds Present in Petroleum	The University of Texas
23.	Limestones and Dolomites as Reservoir Rocks	University of Illinois

Project No.	Subject	Locale
25.	Determination of Geothermal Gradients in Oil Fields on Anticlinal Structure	University of Oklahoma, The University of Texas, and University of California
26.	Determination of Thermal Conductivity of Gases and Its Application to the Precise Analysis of Hydrocarbons and Other Gases	U. S. Geological Survey
28.	A Study of the Reactions of a Number of Selected Organic Sulfur Compounds	Johns Hopkins University
29.	An Investigation of the Heat Capacities and Free Energies of Some Typical Hydrocarbon Compounds	Stanford University
32.	The Equation of State of Certain Easily Liquefiable Hydrocarbons	University of Brussels
36.	The Fundamentals of the Retention of Oil by Sand. Measurements on the Mobility of Suspensions in Rotating Electric Fields.	California Institute of Technology
37.	The Fundamentals of the Retention of Oil by Sand. Fundamental Factors in Removal of Petroleum from the Sands.	California Institute of Technology
38.	Thermodynamic Properties of Petroleum Hydrocarbons	U. S. Bureau of Standards
40.	Specific Absorbents for Sulfur Compounds in Petroleum	Princeton University
41.	The Preparation and Properties of Thiophanes	University of North Carolina

PAPERS PUBLISHED OR APPROVED FOR PUBLICATION

PROJECT 1

Generation of Oil in Rocks by Shearing Pressure.

I. The Problems—Methods of Determining the Soluble Organic Content of Oil Shales. Hawley.

Bull. Am. Assoc. Petroleum Geol. **13,** 303-328 (1929).

II. Effect of Shearing Pressures on Oil Shales and Oil-Bearing Rocks. Hawley.

Bull. Am. Assoc. Petroleum Geol. **13,** 329-65 (1929).

III. Further Effects of High Shearing Pressures on Oil Shales. Hawley.

Bull. Am. Assoc. Petroleum Geol. **14,** 451-81 (1930).

PROJECT 2

Action of Oxygen on 1,4-Dimethylcyclohexane. Chavanne and Bode.

J. Am. Chem. Soc. **52,** 1609-22 (1930).

The Production of Hydrogen and Saturated Gaseous Hydrocarbons by the Action of Oxygen on Side-Chain Saturated Cyclic Hydrocarbons in the Neighborhood of 100 Deg. Chavanne and Miller.

Approved for publication, January 23, 1930.

The Preparation of 1,1-Dimethylcyclohexane and 1,1-Dimethylcyclopentane—Stability of These Hydrocarbons in the Presence of Oxygen. Chavanne, Miller and Cornet.

Approved for publication, May 16, 1930.

PROJECT 3

Microthermal Studies of Some "Mother Rocks" of Petroleum from Alaska. Stadnichenko.

Bull. Am. Assoc. Petroleum Geol. **13,** 823-48 (1929).

Effects of Metamorphism on Certain Débris in Source Sediments. Stadnichenko.

Approved for publication, March 14, 1930.

PROJECT 4

Oceanography and Oil Deposits. Trask.

Trans. Am. Geophys. Un., Bull. Natl. Research Council **61,** 235-42 (1927).

Results of Distillation and Other Studies of the Organic Nature of Some Modern Sediments. Trask.

Bull. Am. Assoc. Petroleum Geol. **11,** 1221-30 (1927).

Limestone as a Source of Oil. Trask.

Bull. Am. Assoc. Petroleum Geol. **12,** 556-7 (1928).

The Potential Value of Several Recent American Coastal and Inland Deposits as Future Source Beds of Petroleum. Trask.

Bull. Am. Assoc. Petroleum Geol. **12,** 1057-68 (1928).

Free Sulfur in Sediments. Trask and Wu.

Bull. Geol. Soc. Am. **41,** March (1930).

Analysis of Oil and Gas from Distillation of Recent Sediments. Trask and Wu.

Econ. Geol. **25,** 235-41 (1930).

Sedimentation Tube for Mechanical Analysis. Trask.

Science **71,** 441-2 (1930).

Summary of Results Obtained to Date by the American Petroleum Institute Research Investigation on the Origin and Environments of Source Sediments. Trask.

Bull. Am. Assoc. Petroleum Geol. **14,** 311-4 (1930).

Mechanical Analysis of Sediments by Centrifuge. Trask.

Econ. Geol. **25,** (1930).

Sedimentation in the Channel Region. Trask.

Approved for publication, June 26, 1930.

Does Petroleum Form in Sediments at Time of Deposition? Wu and Trask.

Approved for publication, June 30, 1930.

PROJECT 5

The Colorimetric Determination of Silica in the Presence of Phosphates and Iron. Thayer.

Ind. Eng. Chem. (Anal. Ed.) **2,** 276-83 (1930).

PROJECT 6

Apparatus and Methods for the Separation, Identification, and Determination of the Chemical Constituents of Petroleum. Washburn, Bruun, Shepherd and Hicks.

Bur. Stds. J. Res. **2,** 467-88 (1929).

The Principles of Measurement and of Calculation in Their Application to the Determination of Diophantine Quantities. Washburn.

Bur. Stds. J. Res. **4,** 221-46 (1930).

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Ind. Eng. Chem. (Anal. Ed.) **1,** 212-3 (1929).

Convenient Reflux Regulator for Laboratory Stills. Bruun.

Ind. Eng. Chem. (Anal. Ed.) **2,** 187-8 (1930).

The Problem of Establishing the Identity and Purity of a Hydrocarbon

Obtained from Petroleum. Washburn.
Approved for publication, February 22, 1930.
An Improved Victor Meyer Molecular-Weight Apparatus. Hicks.
Approved for publication, May 20, 1930.
The Isolation of the Isomers of Hexane from Petroleum. Bruun and Hicks.
Approved for publication, May 20, 1930.
The Determination of the Empirical Formula of a Hydrocarbon. Washburn.
Approved for publication, July 7, 1930.

PROJECT 7

Equilibrium in the Reactions—$CH_4+2H_2O \rightleftharpoons CO_2+4H_2$. Pease and Chesebro.
J. Am. Chem. Soc. **50,** 1464-9 (1928).
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J. Am. Chem. Soc. **50,** 1779-85 (1928).
Equilibrium in the Reaction—$C_2H_6 \rightleftharpoons C_2H_4+H_2$. Pease and Durgan.
J. Am. Chem. Soc. **50,** 2715-18 (1928).
Characteristics of Homogeneous, Exothermic Gas Reactions. Pease and Chesebro.
Proc. Natl. Acad. Sci. **14,** 472-5 (1928).
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NATIONAL CODE OF PRACTICES FOR MARKETING REFINED PETROLEUM PRODUCTS

WITH INTERPRETATIONS

The Federal Trade Commission has acted upon the recommendation of the petroleum industry, and approved a "National Code of Practices for Marketing Refined Petroleum Products." The announcement of the commission, dated July 25, 1929, containing the full text of the code authorized is set forth below, with interpretations by the National Committee on Interpretation of the Code.

In promulgating codes of business practices, the commission classifies the provisions of such codes under two sub-divisions, namely Group 1, or "Approved Practices"; Group 2, or "Expressions of the Trade."

The Group 1 classification—"Approved Practices"—contains those provisions of the code prohibiting practices which are regarded in law as unfair methods of competition.

Section 5 of the Federal Trade Commission Act reads as follows:

"That unfair methods of competition in commerce are hereby declared unlawful. The commission is hereby empowered and directed to prevent persons, partnerships, or corporations, except banks and common carriers subject to the acts to regulate commerce, from using unfair methods of competition in commerce."

This authorizes the commission to proceed formally against anyone practicing an unfair method of competition, whether prohibited by a code of practices or not.

The Group 2 classification—"Expressions of the Trade"—contains rules covering practices which the commission does not regard as being violative of law, the observance of which rules, however, the industry believes would be to its advantage. The enforcement of this second group of rules depends entirely upon the good faith and cooperation of the members of the industry.

The full text of the code follows:

GROUP I

Rule 1

The practice of loaning or leasing gasoline pumps, tanks, and other equipment is unsound and uneconomic, and should be discontinued at the earliest possible moment, consistent with existing conditions. Until such time as this situation can be brought about, and only in those states in which the practice is now observed, gasoline or kerosene pumps and tanks, motor oil equipment and grease outfits (the grease outfits not exceeding in cost $50 each) may be loaned or leased for the exclusive storage and handling of the products of the lender or lessor, but the borrower or lessee shall not be prohibited from handling in other equipment the products of another supplier. Where no equipment is at present installed by any company, or where additional equipment may be added to existing locations, the borrower or lessee shall be required to pay for the installation of each loaned or leased equipment the actual cost of installing said equipment, and for this purpose shall make a cash deposit of at least $100 in advance for each underground unit to be installed, and shall pay, as or when due, all privilege taxes attaching because of the installation or maintenance of such equipment.

(Note by commission: That part of this rule which relates to handling, by the borrower of equipment, of the products of a supplier other than those of the lender of the equipment is approved as a Group I rule—the other portions of the rule being treated, independently as belonging to Group II.)

Interpretation of Rule 1.

The commission approves of the provision in the above-mentioned rule that gasoline or kerosene pumps and tanks, motor oil equipment, and grease outfits may be loaned or leased for the exclusive storage and handling of the products of a lender or lessor solely; and, further, holds as a Group I rule that the action of a dealer in marketing through such equipment the products of a supplier other than those of the lender of the equipment constitutes an unfair method of competition. The remainder of this rule has been placed in Group II by the commission.

The purpose of Rule 1 is to restrict the practice of installing and loaning equipment free of charge. This rule was not intended to change the custom in those states in which it is not now the practice to install and loan equipment free of charge.

In every case of the installation of equipment in a new location or additional installations or installations for increased capacity at an old location, the *actual cost* of installing such equipment shall be paid by the lessee. When an underground unit is to be installed, the lessee shall be required to deposit one hundred dollars ($100) cash in advance on account of the installation cost; and, upon the completion of installation, such advance payment is to be adjusted to the actual installation cost, which is defined to be the entire cost of labor and material (including piping, fittings, concrete work, electric

wiring and connections) required to install such equipment ready for operation. When additional pumps are added to existing underground units, no deposit is required, but the lessee, upon completion of the installation, shall be required to pay the actual installation cost, which is defined to be the entire cost of the labor and material (including pipings, fittings, concrete work, electric wiring and connections) required to install such equipment ready for operation. The installation cost does not include the cost of the pump and tank, foot-valve, fill-box, and the expense of transportation, expressage or drayage.

This rule does not prohibit 100 per cent dealer accounts.

In cases where pumps are substituted for existing equipment of other companies, the present practice of exchanging or selling such existing underground equipment to the installing company is not to be changed.

Replacements can be made of leaky or defective tanks or lines and connections where capacity is not increased. Any increase in capacity is to be treated as a new installation.

This rule applies to loans to consumers as well as to loans to dealers. Some applications of the rule are illustrated by the following examples:

Example 1: When a dealer or consumer is loaned equipment for installation at the place of business where, prior to the loan, no equipment has existed, the lender must require the borrower to pay the cost of installing the equipment.

Example 2: When a dealer or consumer is loaned equipment in addition to that already existing at the place of installation, the lender must require the borrower to pay the cost of installation; for instance, if dealer X, already having two of wholesaler B's pumps installed, applies to wholesaler B or any other wholesaler for the loan and installation of a third pump and tank, the cost of installation must be paid by dealer X.

Example 3: Where the proposed loan is to replace existing equipment, whether belonging to the new lender or to someone else, the borrower need not be required to pay the cost of installation. For instance, if dealer X has two of wholesaler B's pumps and arranges with wholesaler B to replace one of the existing pumps with another, or with wholesaler C, to replace wholesaler B's pump with wholesaler C's, dealer X need not be required to pay the cost of installation. Equipment may be installed without requiring the borrower to pay the cost of installation only when the equipment which is being replaced has been actually removed. If B for any reason fails to remove the pumps (or tanks) after the notice required by the equipment lease, or in the absence of any requirement in the equipment lease required by the rule of the state committee, dealer X or wholesaler C may remove the equipment, and on the completion of removal wholesaler C may make its own installation.

Example 4: Where the borrower, himself, installs the equipment at his own expense, the lender need not collect any installation cost, even though the unit installed may be an additional unit.

Rule 2

Refining companies, wholesalers, distributors, and/or jobbers may acquire by bona fide leases or sub-leases, service and filling stations or sites for same, and such stations and/or sites may be leased or licensed by such company to dealers for the purpose of distributing its products. Such stations and/or sites shall not be acquired at one rental and then sub-leased

or licensed at a reduced rental for the purpose of rebating. In the event the company makes improvements to such properties prior to sub-leasing same, such sub-lease shall provide in addition for reasonable return upon the cost of such improvements, in order that the transaction may not result in rebating.

INTERPRETATION OF RULE 2.

This rule prohibits the rental by refining companies, wholesalers, distributors and/or jobbers of service stations or sites (meaning thereby all places where refined products are, or are intended to be, sold) at one rental and leasing or licensing the same property to the lessor, or third parties, at a reduced rental. If the refining companies, wholesalers, distributors, and/or jobbers place any improvements on said leased properties, such sub-leases shall provide, in addition, for a reasonable return upon the cost of such improvements. In event of a change in traffic conditions or physical surroundings after acquisition of the property by the company, either increasing or diminishing its value, a reasonable return on the fair value of the property for filling station purposes at the time of leasing should be required.

The cost in place of gasoline or kerosene pumps or tanks, motor oil equipment, and grease outfits (grease outfits not to exceed $50 each) ordinarily loaned to customers, need not be included in "the fair value of the property for filling station purposes."

The purpose of ths rule was to prohibit the lease and license plan, or lease and license agreements, known generally in the trade. For example, if a refining company, wholesaler, distributor, and/or jobber rents a service station or service station site at a substantial rental, the purpose of this rule was to prohibit the sub-leasing or licensing to a dealer at a materially reduced rental. The same rental, or substantially the same rental, shall be collected from the dealer as is paid by the refining company, wholesaler, distributor, and/or jobber.

The Board of Directors of the American Petroleum Institute, in session at Chicago on December 5, 1929, adopted the followng resolution:

RESOLVED: That, effective immediately, the words "bona fide lease" in Rule 2 of the code of marketing practices be interpreted to mean only formal written leases of not less than one year's duration—stating the actual consideration to be paid as rental by the lessee, containing no privilege of cancellation on the part of the lessor in less than one year, and bearing the written consent of the fee owner of the property; to be filed for record by the lessee within 30 days after execution.

RULE 3

No company shall paint over any sign or colors of another company until it has communicated with the company whose signs or colors are involved, inquiring whether or not the latter company has any written contract which would be violated by the proposed painting. The latter company shall respond promptly, giving the information requested; and if it holds a contract which would be violated, shall offer to submit it for inspection at its office. If the contract so submitted discloses that the proposed painting would constitute a breach of the contract, the painting shall not be done.

INTERPRETATION OF RULE 3.

This rule does not prohibit the painting over of any sign or colors of a supplying company, not protected by contract, with a neutral color when the dealer transfers his account from the company whose signs or colors are being obliterated to another company. By a neutral color is meant a color not customarily used in the painting of the service stations of the company to which the account is transferred.

RULE 4

No refiner, distributor, jobber or wholesaler shall knowingly induce, attempt to induce, or assist a party to break an existing written contract for the sale of petroleum products between that party and another.

INTERPRETATION OF RULE 4.

The Board of Directors of the American Petroleum Institute, in session at New York on June 25, 1930, adopted the following resolution:

RESOLVED: That it was, and is, the intention of this board of directors in recommending the adoption of Rule 4 of the code that companies may buy or lease service stations notwithstanding occupying dealers have sales contracts with other companies; provided either:

1. the contracts with existing suppliers are performed according to their terms; or
2. proper termination notices are given according to the terms of the sales contracts.

RULE 5

All above-ground equipment for refined products shall bear in a conspicuous place the name or trade-mark of the owner or lessor; and no refiner, distributor, jobber, wholesaler or retailer shall knowingly deliver into such equipment any refined product other than the brand designated, or in any way be a party to the substitution of one grade or brand of refined products for another.

RULE 6

Lotteries, prizes, wheels of fortune, and/or other games of chance shall not be used in connection with the sales of gasoline or motor oils.

RULE 7

The selling of refined petroleum products below cost for the purpose of injuring a competitor, and with the effect of lessening competition, is an unfair trade practice.

GROUP II

RULE 8

On account of the special nature of service required in supplying petroleum products to airports, no dispensing or storage equipment of any kind shall be leased, loaned, or otherwise furnished, to airport operators or resellers of petroleum products, except at full cost, including cost of equipment and storage installation.

INTERPRETATION OF RULE 8.

In the case of airports, air-meets and other flying projects, this code prohibits refiners, distributors, jobbers, wholesalers and retailers from:

1. Donating petroleum products of any nature to aviators or operators or to air races or air meets (Rule 16); a reasonable amount of product may be donated to engine manufacturers and airport and airline operators to test, for the purpose of securing approval of such products.
2. Donating money, prizes, products or other things of value, either directly or indirectly, conditioned upon or in connection with the purchase of petroleum products. Supplying company-owned or chartered ships are excepted. (Rules 6 and 16.)
3. Carrying newspaper, display or other advertisements for the benefit of airport operators or other companies or persons not affiliated with the advertising company. This does not prohibit a company advertising its own products, stating that designated airports, operators or other companies or persons are using such products. (Rule 16.)

RULE 9

A lender or lessor of equipment shall neither extend credit to the borrower or lessee for installation costs, nor advance money to him to cover payment of privilege taxes, or any other expense in any manner related to the installation of loaned or leased equipment.

It is not the intention of Rule 1 and Rule 9 to require the payment of installation costs from the borrower or lessee for exchanges and/or substitution in existing equipment on locations where gasoline, kerosene or lubricating oils are being sold upon the date of the Federal Trade Commission's approval of this code. The privilege of exchange or substitution of equipment is declared to extend to all dealers, not merely to the original lenders.

INTERPRETATION OF RULE 9.

See interpretations under Rule 1.

Rule 10

Except as may be provided in Rule 2, refiners, wholesalers, distributors, and/or jobbers shall not construct for retailers any driveways, canopies, sheds, greasing pits, building or other structures; do painting other than their standard signs or loaned equipment; make improvements to existing structure facilities; nor furnish or loan air compressors, greasing lifts or racks, or other things of value, except equipment stated in Rule 1 hereof, nor bear any part of the expense of construction work on the premises of resellers, nor loan money for the same.

Interpretation of Rule 10.

The restriction of painting for dealers to the companies' standard signs is understood to mean the customary standard signs of the various companies, with such border painting as may be necessary to give the standard sign proper display qualities; but this does not include the painting of garages, service stations or other buildings, or large wall signs or other unusual painting, although such painted matter may be the design or the company's standard sign or the company's colors. This is not intended to prohibit the painting of stations owned or leased by refiners, distributors, jobbers or wholesalers.

The provision in this rule that air compressors, greasing lifts, racks or similar equipment shall not be loaned or furnished by refiners, wholesalers, distributors and/or jobbers to dealers mean that such equipment shall not be sold, leased, exchanged or furnished in any way by the companies to dealers; and contemplates that the companies are not to sell or handle such equipment except for their own use and in the case of airports as provided in Rule 8 hereof.

The Board of Directors of the American Petroleum Institute, in session at Chicago on December 5, 1929, adopted the following resolution:

Resolved: That, effective immediately, that part of Rule 10 of the National Code of Practices for Marketing Refined Petroleum Products, and the interpretations thereof, relating to the restriction of painting for dealers be entirely suspended in the states comprising the Pacific Coast region, and in such parts of the states of Montana, Idaho, and Utah as the respective state code committees in each of said three states shall specifically designate by formal resolution.

Rule 11

No equipment except trade-marked pump globes and other standard advertising devices shall be loaned to tank car buyers and/or distributors.

Rule 12

Refiners, distributors, jobbers, and/or wholesalers shall not pay rentals or make any allowance for the privilege of installing pumps and tanks, or for displaying advertising on premises where refined products are sold.

Interpretation of Rule 12.

This rule prohibits refiners, distributors, jobbers, and/or wholesalers from paying any sign rental or making any other allowance for displaying advertise-

ment on the premises where refined products are sold. By "premises" is meant the entire area of the station, whether all of it is devoted to the sale of petroleum products or not; and contiguous properties where owned or controlled by the dealer.

RULE 13

Refiners, distributors, jobbers, and/or wholesalers shall not rent from any dealer or consumer any delivery equipment, and shall not purchase from any dealer or consumer any delivery equipment for more than its actual value.

INTERPRETATION OF RULE 13.

Delivery equipment mentioned in this rule includes, but is not limited to, gasoline and/or kerosene pumps, tanks, motor oil equipment, grease outfits, and trucks.

RULE 14

Refining companies, wholesalers, distributors, and/or jobbers may own service and filling stations or sites for same, and may lease such stations and/or sites to dealers for purposes of distributing its products, provided that such leases shall stipulate for a reasonable return to the lessor upon the then fair value of the property for filling station purposes.

INTERPRETATION OF RULE 14.

This rule prohibits the leasing of company-owned property or service station or sites except on a reasonable return to the lessor upon the then fair value of the property for filling station purposes.

In considering "the fair value of the property for filling station purposes," the volume of business which may be reasonably expected to be done at such station should be taken into consideration. The principal factor is the value of the property for filling station purposes and, in certain instances, this may be substantially greater than the ordinary market value of the real estate; and, in other cases, by reason of changes in traffic conditions or physical surroundings, the value for filling station purposes may be substantially less than the ordinary market value of such real estate.

The cost in place of gasoline or kerosene pumps or tanks, motor oil equipment, and grease outfits (grease outfits not exceeding $50 each) ordinarily loaned to customers, need not be included in the "fair value of property for filling station purposes."

RULE 15

Gasoline shall not be sold from tank wagons or trucks to other motor vehicles except in emergency cases.

Rule 16

No oil or other thing of value shall be given away, or special inducement granted, on opening days, special sale days, or other occasions.

Interpretation of Rule 16.

The Board of Directors of the American Petroleum Institute; in session at New York on January 9, 1930, adopted the following resolution:

Be it resolved: That it was, and is the intention of this board of directors in recommending the adoption of Rules 16 and 17 of the code to prohibit the use of trading stamps, trading money, trading receipts, and/or similar plans, devices or schemes in any manner connected with the sale of refined petroleum products.

Rule 17

All refiners, distributors, jobbers, and wholesalers shall conspicuously post, at each point from which they make delivery, the several posted prices of gasoline and kerosene for each class of delivery for such deliveries at the time of delivery.

Retailers and other operators serving consumers through service stations, garages, curb pumps, or pumps located at bulk plants, shall conspicuously post, at the place from which delivery is made, prices at which gasoline, kerosene, and motor oils are sold.

No seller shall make any deviation from his posted prices (whether wholesale or retail) by means of rebates, allowances, bonuses, concessions, benefits, unusual credits, scrip books, or any plan, device, or other scheme which may directly or indirectly permit the buyer to obtain gasoline or kerosene at a lower net cost to him.

Commercial accounts, whether for delivery at service stations or otherwise, may be recognized as an exception to this rule in sections where they are now in vogue, but shall apply only to written contracts for charge accounts.

Interpretation of Rule 17.

All refiners, distributors, jobbers, wholesalers, and retailers are required to conspicuously post the specified price; but the rule does not in any way require the price posted by any refiner, distributor, jobber, wholesaler or retailer to be the same price posted by his competitor. The rule contemplates that each one will determine for himself the prices at which he contemplates selling his products; post those prices on his premises at a place conveniently accessible during business hours to the public, and adhere to such prices until new ones are posted.

The posting of prices under this rule means the posting of tank car prices, tank wagon prices, and service station prices at the respective places from which deliveries are made. Tank car prices should be conspicuously posted

at terminals where tank cars are loaded and at the refinery or refinery office; tank wagon prices at the bulk plant or wholesale distributing centers, and service station prices at all service stations. By tank car prices is meant spot prices, prices at which sales are made under contract, and all allowances made from either spot or contract prices. The posting of tank car prices may be either on the basis of f. o. b. loading point, at destination, or in any other manner which will clearly set out the price actually paid by the purchaser.

Commercial accounts need not be posted when they apply only to written contracts for charge accounts for the delivery into commercial vehicles properly licensed and used for the transportation or delivery of passengers, merchandise, freight or express. Only vehicles bearing a commercial license and used in a commercial business are entitled to the commercial discount.

In states which do not issue special licenses to commercial vehicles, a price not posted should be allowed only to such vehicles as are usually licensed under the commercial series by nearby states which do issue special licenses to commercial vehicles. Trucks, buses, and taxicabs are generally regarded as being commercial vehicles. Vehicles bearing pleasure car licenses, whether operated by salesmen, executives, employees or dealers, are not entitled to the commercial discount. Any deviation from this practice requires the posting of the price.

Rule 18

The practice of making deliveries of gasoline at refineries or wholesale plants into tank wagons or trucks operated by or for the purchasers thereof is discouraged.

Rule 19

Coupon books or other scrip of any nature, if used, shall be sold and redeemed at their face value without any discount.

Rule 20

On a change in the posted price, no adjustments, allowances, credits or refunds shall be given to any buyer on deliveries already made.

Rule 21

Definitions.

For the purpose of this code, the following definitions are adopted:

a. *Consumer.* One who destroys the exchangeable value of a commodity by using it. He is an eligible buyer from service station, tank wagon, tank car, or in packages.

b. *Refiner.* One who refines crude petroleum and natural gas into refined products.

c. *Jobber, Distributor, or Wholesaler.* One who carries a stock of petroleum products to sell to retail dealers or others for resale, but who may also sell direct to consumers.

d. *Retail Dealer.* One who carries a stock of petroleum products to sell to the consumers only.

e. *Commercial Accounts.* Petroleum products sold to persons, firms, or corporations using commercial vehicles in transportation or delivery of passengers, merchandise, freight or express, for use only in such vehicles properly licensed by public authorities for those purposes.

RESOLUTION *

ADOPTED BY BOARD OF DIRECTORS, AMERICAN PETROLEUM INSTITUTE, JULY 30, 1929

WHEREAS, The American Petroleum Institute, on June 29, 1928, initiated a movement to effect agreement upon a national code of practices for marketing refined petroleum products and on December 5, 1928, its board of directors, by unanimous vote of all present, approved the complete text of a code for recommendation to the Federal Trade Commission for its sanction; and

WHEREAS, A trade practice conference and public hearing for the petroleum industry was held at St. Louis, Mo., February 11, 1929, under the auspices, and presided over by the Chairman of the Federal Trade Commission, which conference adopted and approved, without substantial change, the code above referred to; and

WHEREAS, The Federal Trade Commission, on July 25, 1929, announced its action and approval of the following code which conforms substantially to the recommendation made by the Board of Directors of the Institute and by the trade practice conference:

(NOTE.—See text of code elsewhere.)

THEREFORE, BE IT RESOLVED: That the Board of Directors of the American Petroleum Institute, in session in New York, July 30, 1929, hereby approves the Code of Practices for Marketing Refined Petroleum Products as authorized by the Federal Trade Commission; and, believing the same to be a reasonable declaration of fair and good practice and in the interest of the industry and the public, recommends acceptance thereof, as of August 31, 1929, by the units engaged in refining and marketing petroleum products, and urges upon all inter-

* See excerpt from "Plan of Organization and Procedure, Division of Marketing, approved February 11, 1930," which follows this resolution.

ested and concerned honest adherence to, and faithful observance of the provision of said code.

BE IT FURTHER RESOLVED: That the following plan of procedure now be followed by the American Petroleum Institute.

1. A national Committee on Interpretation of the Code, of five members, shall be appointed by the president. Such committee shall from time to time make and publish, for the information of the industry, technical interpretations of the various provisions of the code. Three members acting unanimously shall constitute a quorum.

2. The refining and marketing area of the United States is hereby divided into geographical regions, to wit:

PACIFIC COAST REGION: Washington, Oregon, California, Nevada, Arizona, Honolulu, and Alaska.

ROCKY MOUNTAIN REGION: Montana, Idaho, Wyoming, Utah, Colorado, and New Mexico.

SOUTHWESTERN REGION: Texas, Arkansas, and Louisiana.

MID CONTINENT REGION: Oklahoma and Kansas.

MIDDLE WESTERN REGION: Ohio, Wisconsin, Indiana, Minnesota, Michigan, North Dakota, South Dakota, Illinois, Missouri, Nebraska, and Iowa.

NORTHEASTERN REGION: Maine, New Hampshire, Vermont, Rhode Island, Connecticut, New York, and Massachusetts.

EASTERN REGION: Virginia, Pennsylvania, Delaware, New Jersey, Maryland, District of Columbia, North Carolina, South Carolina, and West Virginia.

SOUTHEASTERN REGION: Georgia, Florida, Kentucky, Tennessee, Alabama, and Mississippi.

3. The existing regional code of ethics committees for the eight regions above defined shall be continued, and the president is authorized to make any additions to the membership of such committees as may be desirable.

4. It shall be the function of each regional committee, either through its own activity direct or through state or such other appropriate sub-committees as the chairman of each regional committee may appoint, and without expense to the Institute:

a. Through conferences, public meetings or personal contact, to undertake to see that every refiner and/or marketer of petroleum and/or its products in the region is informed of the code and understands its provisions.

b. To urge every such refiner and/or marketer doing business in the region to accept and honestly and faithfully observe the provisions of the code.

c. To urge such refiners and/or marketers promptly to advise the Federal Trade Commission in writing of acceptance of, and intention to adhere to, the provisions of the code.

The chairman of each regional committee is authorized and urged to appoint promptly either the state sub-committees or a general or district sub-committee for his region; and such state or other sub-committees are urged, first, to devote their time and vigorous attention to the accomplishment of those objectives indicated in paragraphs a, b, and c.

5. It is recommended that oil men or companies do not make complaints against competitors to the Federal Trade Commission without first having exhausted every amicable means of getting the competitor to follow the provisions of the code. To assist the industry in making interpretations and in adjusting complaints, each state sub-committee, or in the absence of a state committee some other sub-committee designated by the regional committee, or local or district committee formed under the sub-committee indicated, is authorized to function as a " Committee on Conciliation," and the procedure shall be as follows:

a. Disputes with respect to interpretation or complaints against violation of some provision of the code may be filed in writing by the disputants or the complainant with the chairman of the state sub-committee or the other sub-committee designated for the purpose. The sub-committee, acting as a committee on conciliation, may act upon the complaint and attempt to conciliate the competitors involved and obtain strict adherence to the provisions of the code.

b. If the dispute be over the interpretation of some provision of the code, the chairman of the sub-committee on conciliation may report the facts to the executive vice-president of the Institute, who shall refer the case to the National Committee on Interpretation, which should promptly make the interpretation. A brief statement of the facts and the interpretation of the committee shall be published in the Institute's bulletin for the information of the industry.

c. If the complaint be against a competitor for violation of any provision of Group I of the code, and the conciliatory effort of the sub-committee on conciliation fails, its chairman may transmit to the executive vice-president of the Institute a full and complete statement of the facts, and a copy of such statement shall be by him mailed to the Federal Trade Commission for its information.

d. If the complaint be against a competitor for violating any rule or all the rules in Group II of the code, and the conciliatory effort of the sub-committee on conciliation fails, with the approval of the sub-committee its chairman may submit (through the executive vice-president of the Institute) to the National Committee on Interpretation a full statement of all the facts, with the recommendation that in a marketing area, which shall be specifically defined, operation of the Group II provisions of the code may be suspended; and if such recommendation is approved by the National Committee on Interpretation, it shall thereupon take effect, and the Group II rule or rules of the code in the specifically defined marketing area shall be temporarily suspended until such time as the sub-committee on conciliation shall report that the violator or all important competitors in such area are conforming to the rules as set forth in Group II.

6. No formal complaint shall be filed in the name of, or prosecuted on behalf of, the Institute with the Federal Trade Commission against any person or company. Formal complaints, if any, should be filed and prosecuted by individuals or competitive companies.

EXCERPTS FROM PLAN OF ORGANIZATION AND PROCEDURE, DIVISION OF MARKETING

Approved February 11, 1930

Section III. Code Activity.

b. *Eight Regional Committees on Code Conciliation and Adjustments.* The regional committees will be composed of the chairmen of the state code committees in the various regions, ex-officio, and such other members as may be appointed by the chairman of the general committee. Each regional committee may have appropriate sub-committees. These regional com-

mittees will cooperate with the state code committees within their limits, and assist them in their work of conciliation and adjustment with respect to the operation of the code.

NOTE.—The present six regional code committees, described in Section 2 of the resolution of the board of July 30, 1929, will cease to exist. The names of the eight new regions and the territory covered by them are as follows: (NOTE.—See text of board resolution for list of eight regional code committees.)

c. *State Code Committees.* These committees are identical with those already in existence. They will, either directly or through appropriate sub-committees, and without expense to the Institute:

1. Inform refiners and/or marketers in the respective states of the provisions of the code, and urge acceptance and adherence thereto.
2. Function as state committees on interpretation of the code, such action being, however, subject to review and approval or reversal by the National Committee on Interpretation of the Code.

NOTE.—All requests for interpretation of the code should be handled initially by a state code committee or sub-committee thereof. If the state code committee or sub-committee be uncertain as to the correct interpretation, the chairman of the committee or sub-committee should transmit the request to the National Committee on Interpretation of the Code through the secretary of the division.

3. Function as committees on conciliation and adjustment. (The Texas state code committee is expressly excepted from this provision.)

NOTE.—The state code committee or sub-committee should receive and handle initially all complaints involving violations of the provisions of the code. Where required, the cooperation and aid of the regional committee on conciliation and adjustment should be requested.

If the complaint be against a competitor for violation of any provision of Group I of the code, and the conciliatory effort of the state code committee or sub-committee should fail, its chairman may supply the executive vice-president of the Institute with a full and complete statement of the facts for transmittal to the Federal Trade Commission.

If the complaint be against a competitor for violating any rule in Group II of the code, and the conciliatory effort of the state code committee or sub-committee should fail, the committee may recommend to the general committee of the division that the operation of the rule in question in a specifically defined marketing area be suspended—accompanying the recommendation with a full statement of all the pertinent facts. Suspension shall continue until the state

code committee or sub-committee shall report that all important companies are conforming to the rule in question, whereupon it shall again be reinstated in the code.

No formal complaint shall be filed with the Federal Trade Commission against any person or company in the name of, or prosecuted on behalf of the Institute. Formal complaints, if any, should be filed and prosecuted by individual companies. It is recommended, however, that oil companies do not make complaints against competitors to the Federal Trade Commisson without first having gone through the procedure herein provided, and without having exhausted every amicable means of getting the competitor to follow the provisions of the code.

4. Keep written records of their proceedings and supply copies to the secretary of the division and the regional committee chairman. Thus the action of the committees can be reviewed, the interpretations observed, uniformity maintained, and cooperation preserved.

STATISTICAL TABLES RELATIVE TO PETROLEUM

(SUMMARY OF STATISTICS CONTAINED IN AMERICAN PETROLEUM INSTITUTE BULLETIN NO. 18, VOL. XI, MARCH 21, 1930)

FORM No. 1—Production and Consumption of Crude Oil, Natural Gasoline, Benzol and Refined Petroleum Products, Excess and Daily Average Excess of Production or Consumption

Roman type indicates increase and *italic type* indicates decrease in stocks in columns 5 and 6. Roman type indicates excess of production and *italic type* indicates excess of consumption in columns 9 and 10

	Production				Imports		New supply		(c) Increase or decrease all stocks (See Form No. 6)		Indicated consumption (Domestic and exports)	
Total	Domestic crude oil (1) barrels	Natural gasoline (2) barrels	(a) Benzol (3) barrels	Total domestic production (4) barrels	Crude oil (5) barrels	Refined products (6) barrels	Total (7) barrels	Daily average (8) barrels	Total (9) barrels	Daily average (10) barrels	Total (11) barrels	Daily average (12) barrels
1918.....	355,928,000	6,750,000	1,273,000	363,951,000	37,736,000	1,207,000	402,894,000	1,103,800	*16,249,000*	*44,500*	419,143,000	1,148,300
1919.....	378,367,000	8,370,000	1,497,000	388,234,000	52,821,000	1,340,000	442,395,000	1,212,000	8,823,000	24,200	433,572,000	1,187,800
1920.....	442,929,000	9,161,000	1,771,000	453,861,000	106,175,000	2,619,000	562,655,000	1,537,300	28,911,000	79,000	533,744,000	1,458,300
1921.....	472,183,000	10,713,000	1,348,000	484,244,000	125,364,000	3,412,000	613,020,000	1,679,500	83,211,000	228,000	529,809,000	1,451,500
1922.....	557,531,000	12,044,000	1,688,000	571,263,000	130,255,000	5,692,000	707,210,000	1,937,600	103,430,000	283,400	603,780,000	1,654,200
1923.....	732,407,000	19,434,000	2,327,000	754,168,000	82,015,000	17,593,000	853,776,000	2,339,100	103,209,000	282,800	750,567,000	2,056,300
1924.....	713,940,000	22,235,000	2,203,000	738,378,000	77,776,000	16,758,000	832,912,000	2,275,700	25,461,000	69,600	807,451,000	2,206,100
1925.....	763,743,000	26,307,000	1,857,000	791,907,000	61,824,000	16,313,000	870,044,000	2,383,700	29,286,000	80,200	840,758,000	2,303,500
1926.....	770,874,000	32,305,000	2,112,000	805,291,000	60,382,000	20,902,000	886,575,000	2,429,000	*18,067,000*	*49,500*	904,642,000	2,478,500
1927.....	901,129,000	38,657,000	2,562,000	942,348,000	58,382,000	13,280,000	1,014,010,000	2,778,100	69,322,000	189,900	944,688,000	2,588,200
1928.....	901,474,000	42,326,000	2,809,000	946,609,000	79,767,000	11,400,000	1,037,776,000	2,835,500	23,450,000	64,100	1,014,326,000	2,771,400
1929.....	(b)1,005,598,000	52,271,000	3,055,000	1,060,924,000	78,915,000	29,652,000	1,169,491,000	3,204,100	67,125,000	183,900	1,102,366,000	3,020,200

NOTE.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (*a*) Estimated by Bureau of Mines with production of by-product coke as a basis. (*b*) Does not include crude consumed as fuel on leases and changes in producers' stocks. (*c*) This column also represents excess of production or consumption.

Authorities: Domestic crude oil production and stock changes from figures of Bureau of Mines. Imports from figures of Bureau of Foreign and Domestic Commerce. Increase or decrease in crude stocks at refineries includes all liquid stocks (crude and refined) for years 1918 to 1922 and all stocks for 1923 and subsequent.

FORM No. 2—Exports of Crude Oil and Refined Products and Domestic Consumption and Excess of Domestic Consumption or Production of Crude Oil, Refined Petroleum Products, Natural Gasoline and Benzol

Total	(a) Total indicated consumption (domestic and export) (1) barrels	Exports				Fuel or bunker oil laden on vessels engaged in foreign trade (6) barrels	(b) Indicated domestic consumption (7) barrels	(d) Total domestic production (8) barrels	Excess of domestic consumption or production	
		Foreign countries (2) barrels	Non-contiguous territories of the U. S. (3) barrels	Foreign oil (4) barrels	Total (5) barrels				Total (9) barrels	Daily average (10) barrels
1918.....	419,143,000	64,628,000	2,421,000	4,000	67,053,000	6,603,000	345,487,000	363,951,000	18,464,000	50,600
1919.....	433,572,000	58,565,000	3,406,000	94,000	62,065,000	14,031,000	357,476,000	388,234,000	30,758,000	84,300
1920.....	533,744,000	73,323,000	3,497,000	712,000	77,532,000	26,335,000	429,877,000	453,861,000	23,984,000	65,500
1921.....	529,809,000	66,398,000	3,916,000	73,000	70,387,000	27,027,000	432,395,000	484,244,000	51,849,000	142,100
1922.....	603,780,000	69,587,000	3,115,000	171,000	72,873,000	31,692,000	499,215,000	571,263,000	72,048,000	197,400
1923.....	750,567,000	94,974,000	5,108,000	333,000	100,415,000	37,582,000	612,570,000	754,168,000	141,598,000	387,900
1924.....	807,451,000	111,022,000	4,159,000	404,000	115,585,000	43,326,000	648,540,000	738,378,000	89,838,000	245,500
1925.....	840,758,000	106,943,000	4,659,000	196,000	111,798,000	42,827,000	686,133,000	791,907,000	105,774,000	289,800
1926.....	904,642,000	123,819,000	4,982,000	5,000	128,806,000	46,661,000	729,175,000	805,291,000	76,116,000	208,500
1927.....	944,688,000	131,317,000	5,727,000	6,000	137,050,000	50,051,000	757,587,000	942,348,000	184,761,000	506,200
1928.....	1,014,326,000	145,124,000	4,219,000	17,000	149,360,000	51,226,000	813,740,000	946,609,000	132,869,000	363,000
1929.....	1,102,366,000	152,798,000	4,984,000	10,000	157,792,000	52,477,000	892,097,000	1,060,924,000	168,827,000	462,500

NOTE.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (a) "Indicated consumption" represents total consumption as shown in column 11 of Form No. 1. (b) "Indicated domestic consumption" in column 7 is difference between column 1 and column 5 plus 6. (c) Does not include crude consumed as fuel on leases and changes in producers' stocks. (d) This column is same as column 4 of Form No. 1.

Authorities for basic figures are the same as in Form No. 1. "Exports" and "fuel or bunker oil" figures in columns 2 to 6 inclusive were taken from the Bureau of Foreign and Domestic Commerce reports.

Form No. 3—Production of Crude Oil and Well Completions

(This table is an analysis of column No. 1, of statistical Form No. 1. The table analyzes the production of crude oil in the United States by fields)

Total and average	Eastern				Mid Continent				Gulf Coast			
	Production barrels	Daily average barrels	Wells completed		Production barrels	Daily average barrels	Wells completed		Production barrels	Daily average barrels	Wells completed	
			Total	Producing oil wells			Total	Producing oil wells			Total	Producing oil wells
1918	41,988,000	115,000	8,287	5,697	179,383,000	491,500	14,800	10,283	24,208,000	66,300	1,637	950
1919	47,276,000	129,500	11,060	8,269	193,147,000	529,200	15,926	11,307	23,366,000	64,000	1,238	649
1920	44,464,000	121,500	11,234	8,331	250,111,000	683,400	19,982	14,031	27,682,000	75,600	1,760	1,034
1921	43,789,000	120,000	8,303	5,497	258,461,000	708,100	11,088	7,212	36,371,000	99,600	1,076	611
1922	41,680,000	114,200	9,207	6,423	310,992,000	852,000	12,742	8,836	37,117,000	101,700	1,330	751
1923	40,129,000	109,900	8,308	5,381	348,460,000	954,700	13,046	8,410	33,271,000	91,200	1,404	930
1924	38,090,000	104,100	7,365	4,705	375,479,000	1,025,900	11,452	7,279	28,569,000	78,100	949	607
1925	38,242,000	104,800	7,621	4,937	424,331,000	1,162,500	14,288	8,678	33,112,000	90,700	1,157	746
1926	39,114,000	107,200	7,943	5,495	423,867,000	1,161,300	17,600	10,912	45,275,000	124,000	1,255	807
1927	40,448,000	110,800	7,340	5,095	546,987,000	1,498,600	13,437	7,318	52,069,000	142,600	1,100	640
1928	40,748,000	111,300	6,995	4,555	553,125,000	1,511,300	12,248	6,129	46,591,000	127,300	1,299	704
1929	46,876,000	128,400	9,964	6,872	584,751,000	1,602,100	12,689	6,368	55,574,000	152,300	1,687	1,000

Total and average	Rocky Mountain				California			Total—United States			Total—East of Rockies			
	Production barrels	Daily average barrels	Wells completed		Production barrels	Daily average barrels	(a)Producing oil wells completed	Production barrels	Daily average barrels	Producing oil wells completed	Production barrels	Daily average barrels	Wells completed	
			Total	Producing oil wells									Total	Producing oil wells
1918	12,809,000	35,100	....	....	97,532,000	267,200	586	355,928,000	975,100	17,516	258,396,000	707,900	24,724	16,930
1919	13,383,000	36,700	286	182	101,183,000	277,200	559	378,367,000	1,036,600	20,966	277,184,000	759,400	28,510	20,407
1920	17,282,000	47,200	348	254	103,377,000	282,500	572	442,929,000	1,210,200	24,222	339,552,000	927,700	33,324	23,650
1921	20,950,000	57,400	430	326	112,600,000	308,500	704	472,183,000	1,293,600	14,350	359,583,000	985,100	20,897	13,646
1922	29,261,000	80,200	552	491	138,468,000	379,400	837	557,531,000	1,527,500	17,338	419,063,000	1,148,100	23,831	16,501
1923	47,653,000	130,600	699	578	262,876,000	720,200	980	732,407,000	2,006,600	16,279	469,531,000	1,286,400	23,457	15,299
1924	42,869,000	117,100	862	715	228,933,000	625,500	1,238	713,940,000	1,950,700	14,544	485,007,000	1,325,200	20,628	13,306
1925	35,554,000	97,400	1,300	986	232,492,000	637,000	948	763,743,000	2,092,400	16,523	531,251,000	1,455,400	24,366	15,575
1926	37,945,000	103,900	1,218	828	224,673,000	615,600	913	770,870,000	2,112,000	18,955	546,201,000	1,496,400	28,016	18,042
1927	30,429,000	83,400	1,088	617	231,196,000	633,400	901	901,129,000	2,468,800	14,571	669,933,000	1,835,400	22,960	13,670
1928	29,199,000	79,800	782	392	231,811,000	633,300	712	901,474,000	2,463,000	12,492	669,663,000	1,829,700	21,324	11,780
1929	26,360,000	72,200	738	359	292,037,000	800,100	910	(b)1,005,598,000	2,755,100	15,509	713,561,000	1,955,000	25,078	14,599

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. Total United States production includes in 1918, 8,000 bbl.; in 1919, 12,000 bbl.; in 1920, 13,000 bbl.; in 1921, 12,000 bbl.; in 1922, 13,000 bbl.; in 1923, 18,000 bbl.; and in 1925, 12,000 bbl., credited to "*Others*" in U. S. Geological annual report. (*a*) Total completions for California not available. (*b*) Does not include crude consumed as fuel on leases and changes in producers' stocks.

Authorities: Production figures taken from Bureau of Mines preliminary reports, which are subject to correction. Figures for wells are compiled from the *Oil and Gas Journal* for all fields except California, and from the *Standard Oil Bulletin* and the American Petroleum Institute reports for California.

Form No. 4—Imports of Crude Oil and Refined Products Into the United States

(This table is an analysis of column No. 2, of statistical Form No. 1)

Total and average	(a) Crude oil								(b) Refined products		Total imports	
	From Mexico, barrels	(c) From Dutch West Indies, barrels	From Venezuela, barrels	From Colombia, barrels	From Peru, barrels	Others barrels	Total all countries, barrels	Daily average, barrels	Total barrels	Daily average, barrels	From all countries, barrels	Daily average, barrels
1918.....	37,719,000	.....	.....	.....	.....	17,000	37,736,000	103,400	1,207,000	3,300	38,943,000	106,700
1919.....	52,751,000	.....	.....	.....	.....	70,000	52,821,000	144,700	1,340,000	3,700	54,161,000	148,400
1920.....	106,163,000	.....	.....	.....	.....	12,000	106,175,000	290,100	2,619,000	7,200	108,794,000	297,300
1921.....	125,241,000	.....	.....	.....	.....	123,000	125,364,000	343,500	3,412,000	9,300	128,776,000	352,800
1922.....	129,142,000	735,000	.....	.....	.....	378,000	130,255,000	356,900	5,692,000	15,600	135,947,000	372,500
1923.....	79,495,000	810,000	.....	.....	1,554,000	156,000	82,015,000	224,700	17,593,000	48,200	99,608,000	272,900
1924.....	73,862,000	1,186,000	.....	.....	2,430,000	298,000	77,776,000	212,500	16,758,000	45,800	94,534,000	258,300
1925.....	55,049,000	3,274,000	1,417,000	.....	1,825,000	259,000	61,824,000	169,400	16,313,000	44,700	78,137,000	214,100
1926.....	40,398,000	7,088,000	5,197,000	3,621,000	3,044,000	1,034,000	60,382,000	165,400	20,902,000	57,300	81,284,000	222,700
1927.....	26,018,000	10,137,000	11,422,000	7,962,000	1,888,000	955,000	58,382,000	159,900	13,280,000	36,400	71,662,000	196,300
1928.....	17,584,000	24,990,000	21,988,000	11,838,000	1,224,000	2,143,000	79,767,000	218,000	11,400,000	31,100	91,167,000	249,100
1929.....	12,663,000	16,225,000	34,413,000	12,620,000	1,454,000	1,540,000	78,915,000	216,200	29,652,000	81,200	108,567,000	297,400

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (a) Prior to the year 1923, topped oil is included. (b) Includes benzine, gasoline, naphtha and all other refined oils. (c) From information obtainable, it is believed that all of this oil is of Venezuelan origin.

Authority: Figures are taken from the monthly reports of the Bureau of Foreign and Domestic Commerce.

Form No. 5—Pipe Line and Tank Farm Crude Oil Stocks

(In columns showing "increase or decrease," roman type indicates increases and *italic type* indicates decreases)

	Eastern			Mid Continent			Gulf Coast		
		Increase or decrease			Increase or decrease			Increase or decrease	
	Stocks at end of period, barrels	barrels	Daily average, barrels	Stocks at end of period, barrels	barrels	Daily average, barrels	Stocks at end of period, barrels	barrels	Daily average, barrels
1918	7,012,000	*2,276,000*	*6,200*	79,094,000	*20,333,000*	*55,700*	8,168,000	*216,000*	*600*
1919	9,274,000	2,262,000	6,200	76,712,000	*2,382,000*	*6,500*	12,575,000	4,407,000	12,100
1920	7,430,000	*820,000*	*2,200*	75,690,000	14,984,000	40,900	11,163,000	*264,000*	*700*
1921	15,419,000	7,989,000	21,900	102,401,000	26,711,000	73,200	17,606,000	6,443,000	17,700
1922	19,693,000	4,274,000	11,700	152,573,000	50,172,000	137,400	24,781,000	7,175,000	19,700
1923	21,276,000	1,583,000	4,300	202,904,000	50,331,000	137,900	23,974,000	*807,000*	*2,200*
1924	21,377,000	101,000	300	210,558,000	7,654,000	20,900	20,200,000	*3,774,000*	*10,300*
1925	20,046,000	*1,331,000*	*3,700*	195,941,000	*14,617,000*	*40,000*	19,263,000	*937,000*	*2,600*
1926	20,226,000	180,000	500	173,848,000	*22,093,000*	*60,500*	20,031,000	768,000	2,100
1927	20,638,000	412,000	1,100	246,839,000	72,991,000	200,000	17,922,000	*2,109,000*	*5,800*
1928	18,044,000	*263,000*	*8,500*	265,748,000	1,529,000	49,300	18,272,000	*101,000*	*3,200*
1929	16,204,000	193,000	6,200	274,072,000	*813,000*	*26,200*	20,129,000	*331,000*	*10,700*

	Rocky Mountain			Total—East of California			California		
		Increase or decrease			Increase or decrease			Increase or decrease	
	Stocks at end of period, barrels	barrels	Daily average, barrels	Stocks at end of period, barrels	barrels	Daily average, barrels	Stocks at end of period, barrels	barrels	Daily average, barrels
1918	915,000	399,000	1,100	95,189,000	*22,426,000*	*61,400*	26,538,000	*1,888,000*	*5,200*
1919	164,000	*751,000*	*2,100*	98,725,000	3,536,000	9,700	29,142,000	2,604,000	7,100
1920	636,000	135,000	400	94,919,000	14,035,000	38,400	20,930,000	*8,212,000*	*22,400*
1921	1,635,000	999,000	2,700	137,061,000	42,142,000	115,500	33,289,000	12,359,000	33,900
1922	1,991,000	356,000	1,000	199,038,000	61,977,000	169,800	49,375,000	16,086,000	44,100
1923	19,704,000	17,713,000	48,500	267,858,000	68,820,000	188,500	62,162,000	12,787,000	35,000
1924	28,672,000	8,968,000	24,500	280,807,000	12,949,000	35,400	.....	.....	.....
1925	28,995,000	323,000	900	264,245,000	*16,562,000*	*45,400*	.....	.....	.....
1926	28,075,000	*920,000*	*2,500*	242,180,000	*22,065,000*	*60,400*	.....	.....	.....
1927	27,238,000	*837,000*	*2,300*	312,637,000	70,457,000	193,000	.....	.....	.....
1928	25,501,000	*213,000*	*6,900*	327,565,000	952,000	30,700	.....	.....	.....
1929	24,679,000	7,000	200	335,084,000	*944,000*	*30,500*	.....	.....	.....

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. Commencing with January 1, 1921, the U. S. Geological Survey changed its method of reporting stocks. Stocks shown above for 1921 and all subsequent stocks are on the new basis.

Authority: Figures taken from Bureau of Mines monthly reports, which are subject to correction.

Form No. 6—Stocks of Crude Oil, Natural Gasoline and Refined Petroleum Products

	East of California		Producers stocks of crude oil		(b) Foreign crude oil in U. S. not at refineries	Refinable crude in Pacific Coast territory	California pipe line and tank farm and refinery stocks of crude	Stocks of heavy crude including all grades of fuel in Pacific Coast territory	(c) Stocks of refined products at refineries east of California	(c) Stocks of refined products in Pacific Coast territory	(v) Natural gasoline stocks		Total all stocks of crude and refined products
	Pipe line and tank farm crude oil stocks barrels (1)	Crude oil stocks at refineries barrels (2)	East of California barrels (3)	California barrels (4)	barrels (5)	barrels (6)	barrels (7)	barrels (8)	barrels (9)	barrels (10)	East of California barrels (11)	California barrels (12)	barrels (13)
1918....	95,189,000	14,057,000	2,033,000	(s)	(d)	.....	28,231,000	.....	39,844,000	7,958,000	.....	.....	187,312,000
1919....	98,725,000	11,793,000	4,089,000	.....	(d)	.....	31,829,000	.....	42,582,000	7,117,000	.....	.....	196,135,000
1920....	(a)112,760,000	19,769,000	3,586,000	.....	7,442,000	.....	22,422,000	.....	51,946,000	7,121,000	.....	.....	225,046,000
1921....	137,061,000	25,053,000	5,139,000	.....	13,540,000	.....	34,798,000	.....	66,160,000	8,665,000	.....	.....	290,416,000
1922....	199,038,000	30,671,000	8,428,000	.....	1,383,000	(g)	52,509,000	(h)	71,268,000	15,767,000	.....	.....	393,846,000
1923....	267,858,000	27,716,000	9,850,000	.....	(b)16,165,000	.....	67,705,000	.....	74,471,000	(i)33,725,000	(u)	(u)	482,708,000
1924....	(f)280,807,000	31,184,000	8,389,000	.....	734,000	40,541,000	.....	55,964,000	74,799,000	27,570,000	292,000	10,000	520,290,000
1925....	264,245,000	(l)27,157,000	7,560,000	.....	407,000	(e)44,451,000	.....	(ek)84,983,000	94,104,000	26,346,000	310,000	16,000	549,579,000
1926....	242,180,000	35,475,000	5,904,000	.....	609,000	(j)30,861,000	.....	(jn)87,270,000	97,583,000	(j)25,725,000	499,000	34,000	526,140,000
1927....	312,637,000	39,317,000	7,536,000	.....	84,000	20,086,000	.....	93,719,000	98,231,000	24,124,000	737,000	30,000	596,501,000
1928....	327,565,000	40,529,000	6,521,000	.....	259,000	(p)16,995,000	.....	(r)98,919,000	107,648,000	20,882,000	606,000	27,000	619,951,000
1929....	335,084,000	46,195,000	6,050,000	.....	112,000	41,049,000	.....	106,499,000	118,148,000	34,378,000	584,000	36,000	688,135,000

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (a) Commencing January 1, 1921, the U. S. Geological Survey changed its method of reporting stocks, and for comparison with subsequent years this figure should read 94,919,000 bbl. (b) Prior to January 1, 1923, Mexican stocks included topped oil and duplication of crude at refineries. Mexican stocks on hand December 31, 1922, comparable with those of subsequent months, amounted to 1,818,000 bbl. (c) Prior to January 1923, only liquid stocks at refineries were used. Total stocks at U. S. refineries at end of December 1922, comparable with those of subsequent months, amounted to 89,643,000 bbl. (d) Mexican stocks not available prior to January 1920. (e) During August, 1,180,000 bbl. were transferred from stocks of refinable crude to heavy crude and fuel oil stocks. (f) During August, there were added 1,462,000 bbl. of pipe line crude not previously reported. (g) Stocks of refinable crude in Pacific Coast territory on December 31, 1923, comparable with subsequent months, amounted to 35,098,000 bbl. (h) Stocks of heavy crude, including all grades of fuel in Pacific Coast territory on December 31, 1923, comparable with subsequent months, amounted to 49,612,000 bbl. (i) Due to change of method in reporting stocks in California, stocks of refined products in Pacific Coast territory, comparable with subsequent months, amounted to 27,379,000 bbl. (j) See notes on Form 6 (Cont'd) for explanation of fire loss in California. (k) Due to inclusion of 800,000 bbl. of pipe line working stocks, not previously reported, stocks on December 31, 1925, comparable with subsequent months, amounted to 85,783,000 bbl. (l) Due to inclusion of crude in transit to refineries, not previously reported, stocks on December 31, 1925, comparable with subsequent months, amounted to 29,200,000 bbl. (m) During June, there were approximately 1,300,000 bbl., previously classified as refinery crude, transferred to pipe line crude stocks. (n) Due to revision of figures during 1927, stocks of heavy crude, including all grades of fuel in Pacific Coast territory on December 31, 1926, comparable with subsequent months, amounted to 88,309,000 bbl. (p) December 1928 revised. Stocks on that date comparable with subsequent months amounted to 17,755,000 bbl. (r) Stocks on this date comparable with subsequent months amounted to 99,218,000 bbl. (s) Producers stocks in California not available separately. They are included with heavy and refinable crude in columns No. 6 and 8. (t) Beginning with January report these stocks were included with those at refineries. (u) Not available prior to 1924. (v) Includes natural gasoline at plants and at refineries; also blended fuel stocks.

Authorities: Figures taken from Bureau of Mines reports.

FORM No. 6 (*Continued*)—Increase or Decrease in Stocks of Crude Oil, Natural Gasoline and Refined Petroleum Products

(Roman type indicates increase and *italic type* indicates decrease)

	East of California		Producers stocks of crude oil		Foreign crude oil in U. S. not at refineries barrels (5)	Refinable crude in Pacific Coast territory barrels (6)	California pipe line and tank farm and refinery stocks of crude barrels (7)	Stocks of heavy crude including all grades of fuel in Pacific Coast territory barrels (8)	Stocks of refined products at refineries east of California barrels (9)	Stocks of refined products in Pacific Coast territory barrels (10)	Natural gasoline stocks		Net increase or decrease all stocks of crude and refined products barrels (13)
	Pipe line and tank farm crude oil stocks barrels (1)	Crude oil stocks at refineries barrels (2)	East of California barrels (3)	California barrels (4)							East of California barrels (11)	California barrels (12)	
1918.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*16,249,000*
1919.....	3,536,000	*2,264,000*	2,056,000	.....	(*d*)	.....	3,598,000	.....	2,738,000	*841,000*	.....	.....	8,823,000
1920.....	14,035,000	7,976,000	*503,000*	.....	7,442,000	.....	*9,407,000*	.....	9,364,000	4,000	.....	.....	28,911,000
1921.....	42,142,000	5,284,000	1,553,000	.....	6,098,000	.....	12,376,000	.....	14,214,000	1,544,000	.....	.....	83,211,000
1922.....	61,977,000	5,618,000	3,289,000	.....	2,625,000	.....	17,711,000	.....	5,108,000	7,102,000	.....	.....	103,430,000
1923.....	68,820,000	*2,955,000*	1,422,000	.....	*435,000*	.....	15,196,000	.....	3,203,000	17,958,000	.....	.....	103,209,000
1924.....	11,487,000	3,468,000	*1,461,000*	.....	*649,000*	5,443,000	.....	6,352,000	328,000	191,000	292,000	10,000	25,461,000
1925.....	*16,562,000*	*4,027,000*	*829,000*	.....	*327,000*	5,090,000	.....	27,839,000	19,305,000	*1,224,000*	15,000	6,000	29,286,000
1926.....	*22,065,000*	6,275,000	*1,656,000*	.....	202,000	(*a*)*8,990,000*	.....	(*b*)4,691,000	3,479,000	(*c*)*210,000*	189,000	18,000	*18,067,000*
1927.....	70,457,000	3,842,000	1,632,000	.....	*525,000*	*10,775,000*	.....	5,410,000	648,000	*1,601,000*	238,000	*4,000*	69,322,000
1928.....	14,928,000	1,212,000	*1,015,000*	.....	175,000	*3,091,000*	.....	5,200,000	9,417,000	*3,242,000*	*131,000*	*3,000*	23,450,000
1929.....	7,519,000	*5,666,000*	*471,000*	.....	*147,000*	23,294,000	.....	12,868,000	10,500,000	7,909,000	*22,000*	9,000	67,125,000

See Form No. 6 for explanation of general notes. (*a*) Does not include 4,600,000 bbl. fire loss. (b) Does not include 3,204,000 bbl. fire loss. (*c*) Does not include 411,000 bbl. fire loss. (d) Does not include 8,215,000 bbl. fire loss in California.

Form No. 7— Production, Imports, Stocks, Exports and Domestic Consumption of Crude Oil

(Roman type indicates increase and *italic type* indicates decrease in columns 6 and 7)

	Domestic crude oil production		(*d*) Imports of crude oil		(*a*) Stocks, crude oil			(*e*) Exports of crude oil		Indicated domestic consumption of crude oil	
						Increase or decrease					
Total	barrels (1)	Daily average, barrels (2)	barrels (3)	Daily average, barrels (4)	End of period, barrels (5)	barrels (6)	Daily average, barrels (7)	barrels (8)	Daily average, barrels (9)	barrels (10)	Daily average, barrels (11)
1918.....	355,928,000	975,100	37,736,000	103,400	139,510,000	*18,170,000*	*49,800*	5,884,000	16,100	405,950,000	1,112,200
1919.....	378,367,000	1,036,600	52,821,000	144,700	146,436,000	6,926,000	19,000	6,253,000	17,100	418,009,000	1,145,200
1920.....	442,929,000	1,210,200	106,175,000	290,100	(*i*) 165,979,000	19,543,000	53,400	8,583,000	23,500	520,978,000	1,423,400
1921.....	472,183,000	1,293,700	125,364,000	343,500	215,591,000	67,453,000	184,800	9,552,000	26,200	520,542,000	1,426,200
1922.....	557,531,000	1,527,500	130,255,000	356,900	(*c*) 306,811,000	91,220,000	249,900	10,637,000	29,200	585,929,000	1,605,300
1923.....	732,407,000	2,006,600	82,015,000	224,700	(*b*) 374,512,000	82,048,000	224,800	17,210,000	47,200	715,164,000	1,959,300
1924.....	713,940,000	1,950,700	77,776,000	212,500	361,655,000	19,750,000	54,000	17,871,000	48,800	754,095,000	2,060,400
1925.....	763,743,000	2,092,400	61,824,000	169,400	(*f*) 343,820,000	*17,835,000*	*48,900*	*13,127,000*	36,000	830,275,000	2,274,700
1926.....	770,874,000	2,112,000	60,382,000	165,400	315,029,000	(*g*) *26,234,000*	*71,900*	15,356,000	42,100	842,134,000	2,307,200
1927.....	901,129,000	2,468,800	58,382,000	160,000	379,660,000	64,631,000	177,100	15,843,000	43,400	879,037,000	2,408,300
1928.....	901,474,000	2,463,000	79,767,000	217,900	.....	12,209,000	33,300	18,966,000	51,800	950,066,000	2,595,800
1929.....	(*h*) 1,005,598,000	2,755,100	78,915,000	216,200	.....	35,861,000	98,200	26,374,000	72,300	1,022,278,000	2,800,800

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (*a*) Includes all stocks of crude oil in the United States for 1923 and prior. Beginning with January 1924 figures include all crude stocks east of California, and in *California the refinable crude stocks only.* Producers' stocks are also included. (*b*) Stocks on December 31, 1923, comparable with subsequent months, amounted to 341,905,000 bbl. (*c*) Due to reduction in stocks because of duplication of Mexican crude at refineries (see note (*b*) Form 6), the total stocks on December 31, 1922, comparable with December 31, 1923, amounted to 292,464,000 bbl. (*d*) Prior to year 1923, topped oil is included. (*e*) Includes exports to foreign countries and to U. S. insular possessions. (*f*) Due to inclusion of crude in transit to refineries, not previously reported, total stocks on December 31, 1925, comparable with subsequent months, amounted to 345,863,000 bbl. (*g*) Does not include 4,600,000 bbl. of refinable crude destroyed by fire in California. (*h*) Does not include crude consumed as fuel on leases and changes in producers' stocks. (*i*) Commencing January 1, 1921, the Bureau of Mines changed its method of reporting stocks, making amount in storage as of December 31, 1920, comparable with subsequent years, 148,138,000 bbl.

Authorities: Domestic crude oil production and stock figures are taken from Bureau of Mines reports. Imports and exports from reports of Bureau of Foreign and Domestic Commerce.

Form No. 8—Production, Imports, Stocks, Exports and Domestic Consumption of Motor Fuel

(Roman type indicates increase and *italic type* indicates decrease in stocks in columns 11 and 12)

	Production					Imports		Stocks end of period			Increase or decrease		(e) Exports		Indicated domestic consumption of motor fuel	
Total	(a) Gasoline at refineries barrels (1)	Natural gasoline (see note (b) below) barrels (2)	(c) Benzol barrels (3)	Total motor fuel barrels (4)	Daily average (5)	Total barrels (6)	Daily average (7)	Gasoline at refineries barrels (8)	(d) Natural gasoline barrels (9)	Total stocks barrels (10)	Total barrels (11)	Daily average (12)	Total barrels (13)	Daily average (14)	barrels (15)	Daily average (16)
1918....	85,007,000	4,299,000	1,273,000	90,579,000	248,200	307,000	800	7,080,000	.....	7,080,000	*2,736,000*	*7,500*	13,544,000	37,100	80,078,000	219,400
1919....	94,235,000	5,413,000	1,497,000	101,145,000	277,100	203,000	600	10,638,000	.....	10,638,000	3,558,000	9,800	9,097,000	24,900	88,693,000	243,000
1920....	116,251,000	6,008,000	1,771,000	124,030,000	338,900	964,000	2,600	11,009,000	.....	11,009,000	371,000	1,000	15,636,000	42,700	108,987,000	297,800
1921....	122,704,000	8,196,000	1,348,000	132,248,000	362,300	900,000	2,500	13,954,000	.....	13,954,000	2,945,000	8,100	13,134,000	36,000	117,069,000	320,700
1922....	147,672,000	8,382,000	1,688,000	157,742,000	432,200	1,479,000	4,000	21,043,000	.....	21,043,000	7,089,000	19,400	14,156,000	38,800	137,976,000	378,000
1923....	179,903,000	13,947,000	2,327,000	196,177,000	537,500	4,555,000	12,500	(f)25,593,000	.....	25,593,000	4,550,000	12,500	20,741,000	56,800	175,441,000	480,700
1924....	213,326,000	9,564,000	2,203,000	225,093,000	615,000	3,453,000	9,400	30,823,000	302,000	31,125,000	3,111,000	8,500	28,967,000	79,100	196,468,000	536,800
1925....	259,601,000	6,671,000	1,857,000	268,129,000	734,600	3,813,000	10,400	38,875,000	326,000	39,201,000	8,076,000	22,100	31,497,000	86,300	232,369,000	636,600
1926....	299,734,000	4,609,000	2,112,000	306,455,000	839,600	5,540,000	15,200	39,023,000	533,000	39,556,000	355,000	1,000	43,313,000	118,700	268,327,000	735,100
1927....	330,435,000	6,495,000	2,562,000	339,492,000	930,100	5,003,000	13,700	33,316,000	767,000	34,083,000	*5,473,000*	*15,000*	44,337,000	121,500	305,631,000	837,300
1928....	376,945,000	7,103,000	2,809,000	386,857,000	1,057,000	4,198,000	11,500	.....	.....	.....	*384,000*	*1,000*	52,904,000	144,500	338,535,000	925,000
1929....	434,241,000	6,808,000	3,055,000	444,104,000	1,216,700	8,868,000	24,300	.....	.....	.....	10,036,000	27,500	61,208,000	167,700	381,728,000	1,045,800

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (*a*) Output of U. S. refineries. (*b*) This column represents the difference between the total amount of natural gasoline produced during the month and the amount of natural gasoline run through refineries. (*c*) Estimated by Bureau of Mines with production of by-product coke as a basis. (*d*) Includes natural gasoline in storage at plants and in storage at refineries; also blended fuel stocks. These stocks not available prior to 1924. (*e*) Includes exports classified "Gasoline, Naphtha, etc." to foreign countries and U. S. insular possessions. (*f*) Due to revised method of reporting stocks in California, total stocks of gasoline at refineries in U. S. on December 31, 1923, comparable with subsequent months, amounted to 28,014,000 bbl.

Authorities: Figures for production and stocks are taken from Bureau of Mines reports, and those for imports and exports from the Bureau of Foreign and Domestic Commerce reports.

Form No. 9—Production, Imports, Stocks, Exports and Domestic Consumption of Kerosene

(Roman type indicates increase and *italic type* indicates decrease in stocks in columns 6 and 7)

	(a) Production		Imports		Stocks			(b) Exports		Indicated domestic consumption	
						Increase or decrease					
Total	barrels (1)	Daily average, barrels (2)	barrels (3)	Daily average, barrels (4)	End of period, barrels (5)	barrels (6)	Daily average, barrels (7)	barrels (8)	Daily average, barrels (9)	barrels (10)	Daily average, barrels (11)
1918	43,461,000	119,100	.....	....	9,050,000	*2,801,000*	*7,700*	11,820,000	32,400	34,442,000	94,400
1919	55,753,000	152,700	.....	....	8,079,000	*971,000*	*2,700*	23,536,000	64,500	33,188,000	90,900
1920	55,240,000	150,900	.....	....	9,359,000	1,280,000	3,500	20,878,000	57,000	33,082,000	90,400
1921	46,313,000	126,900	.....	....	8,119,000	*1,240,000*	*3,400*	18,016,000	49,400	29,537,000	80,900
1922	54,913,000	150,500	(c)	....	6,692,000	*1,427,000*	*3,900*	21,489,000	58,900	34,851,000	95,500
1923	55,927,000	153,200	7,000	....	(d) 6,743,000	51,000	100	20,347,000	55,800	35,536,000	97,300
1924	60,026,000	164,000	10,000	....	8,594,000	1,363,000	3,700	21,961,000	60,000	36,712,000	100,300
1925	59,689,000	163,500	19,000	100	7,121,000	*1,473,000*	*4,000*	21,212,000	58,100	39,969,000	109,500
1926	61,768,000	169,200	75,000	200	8,575,000	1,454,000	4,000	22,248,000	60,900	38,141,000	104,500
1927	56,113,000	153,700	54,000	100	7,715,000	*860,000*	*2,400*	19,520,000	53,500	37,507,000	102,700
1928	59,353,000	162,200	202,000	500	.....	1,286,000	3,500	22,034,000	60,200	36,235,000	99,000
1929	57,154,000	156,600	208,000	600	.....	38,000	100	20,018,000	54,900	37,306,000	102,200

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (a) Output of U. S. refineries. (b) Includes exports (classified "illuminating oil") to foreign countries and U. S. insular possessions. (c) Imports prior to October 1922 not available. (d) Due to revised method of reporting stocks in California, total stocks of kerosene in U. S. on December 31, 1923, comparable with subsequent months, amounted to 7,231,000 bbl.

Authorities: Figures for "production" and "stocks" are taken from Bureau of Mines reports, and those for "imports" and "exports" from the Bureau of Foreign and Domestic Commerce reports.

Form No. 10—Production, Imports, Stocks, Exports and Domestic Consumption of Refined Gas and Fuel Oils

(Roman type indicates increase and *italic type* indicates decrease in stocks in columns 6 and 7)

	(a) Production		Imports		(d) Stocks			(b) Exports		Indicated domestic consumption	
						Increase or decrease					
Total	barrels (1)	Daily average, barrels (2)	barrels (3)	Daily average, barrels (4)	End of period, barrels (5)	barrels (6)	Daily average, barrels (7)	barrels (8)	Daily average, barrels (9)	barrels (10)	Daily average, barrels (11)
1918....	174,319,000	477,600	.....	.....	15,691,000	1,931,000	5,300	29,636,000	81,200	142,752,000	391,000
1919....	181,602,000	497,500	.....	.....	17,003,000	1,312,000	3,600	16,487,000	45,100	163,803,000	448,800
1920....	210,987,000	576,500	.....	.....	19,938,000	2,935,000	8,000	22,080,000	60,300	185,972,000	508,200
1921....	230,091,000	630,400	.....	.....	31,697,000	11,759,000	32,200	22,676,000	62,100	195,656,000	536,100
1922....	254,910,000	698,400	(c)	.....	31,065,000	*632,000*	*1,700*	18,479,000	50,600	237,063,000	649,500
1923....	287,480,000	787,600	12,286,000	33,600	(e)36,072,000	5,007,000	13,700	33,372,000	91,400	261,387,000	716,100
1924....	320,476,000	875,600	12,927,000	35,300	75,520,000	5,388,000	14,700	37,249,000	101,800	290,766,000	794,400
1925....	364,991,000	1,000,000	12,245,000	33,500	(f)109,664,000	34,144,000	93,500	36,088,000	98,900	307,004,000	841,100
1926....	365,195,000	1,000,500	14,430,000	39,500	(h)112,168,000	(g)4,908,000	13,400	38,351,000	105,100	336,366,000	921,500
1927....	393,066,000	1,076,900	8,123,000	22,200	127,741,000	14,534,000	39,800	47,391,000	129,800	339,264,000	929,500
1928....	427,237,000	1,167,300	7,268,000	19,900	.....	6,104,000	16,700	44,427,000	121,400	383,974,000	1,049,100
1929....	447,894,000	1,227,100	20,510,000	56,200	.....	14,867,000	40,700	39,073,000	107,100	414,464,000	1,135,500

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (*a*) Output of U. S. refineries. (*b*) Includes exports (classified "gas, fuel oil, and residuum") to foreign countries and U. S. insular possessions, and does not include fuel or bunker oil laden on vessels engaged in foreign trade. (*c*) Imports prior to October 1922 not available. (*d*) Includes all stocks of refined gas and fuel oil in U. S. for 1923 and prior, but for January 1924 and subsequent months stocks include refined gas and fuel oil east of California, and *in California stocks of heavy crude including all grades of fuel.* (*e*) Stocks on December 31, 1923, comparable with subsequent months, amounted to 70,132,000 bbl. (*f*) Due to inclusion of 800,000 bbl. of pipe line working stocks, not previously reported, stocks on December 31, 1925, comparable with subsequent months, amounted to 110,464,000 bbl. (*g*) Does not include 3,204,000 bbl. of heavy crude destroyed by fire in California. (*h*) Due to revision in stocks of heavy crude, including all grades of fuel oil in California, stocks on December 31, 1926, comparable with subsequent months, amounted to 113,207,000 bbl. (*i*) Due to revision in stocks on December 31, 1928, comparable with subsequent months, amounted to 134,144,000 bbl. (*j*) Approximately 2,500,000 bbl. of gas and fuel oil were transferred to unfinished oils during October, making stocks on hand as of September 30, comparable with subsequent months, 148,278,000 bbl. (*k*) Due to the transfer of 250,000 bbl. of gas and fuel oils to unfinished oils stocks as of December 31, 1929, comparable with subsequent months amounted to 146,261,000 bbl.

Authorities: Figures for "production" and "stocks" are taken from Bureau of Mines reports, and those for "imports" and "exports" from the Bureau of Foreign and Domestic Commerce reports.

Form No. 11—Production, Imports, Stocks, Exports and Domestic Consumption of Lubricants

(Roman type indicates increase and *italic type* indicates decrease in stocks in columns 6 and 7)

	(a) Production		Imports		Stocks			(b) Exports		Indicated domestic consumption	
						Increase or decrease					
Total	barrels (1)	Daily average, barrels (2)	barrels (3)	Daily average, barrels (4)	End of period, barrels (5)	barrels (6)	Daily average, barrels (7)	barrels (8)	Daily average, barrels (9)	barrels (10)	Daily average, barrels (11)
1918	20,035,000	54,900	.....	.....	3,306,000	48,000	100	6,165,000	16,900	13,822,000	37,900
1919	20,161,000	55,200	.....	.....	3,269,000	*37,000*	*100*	6,598,000	18,100	13,600,000	37,200
1920	24,938,000	68,100	.....	.....	3,822,000	553,000	1,500	9,643,000	26,300	14,742,000	40,300
1921	20,896,000	57,200	.....	.....	5,735,000	1,913,000	5,200	6,936,000	19,000	12,047,000	33,000
1922	23,304,000	63,900	(c)	.....	5,613,000	*122,000*	*300*	7,941,000	21,800	15,485,000	42,400
1923	26,128,000	71,600	29,000	100	(d) 5,781,000	168,000	500	8,372,000	22,900	17,617,000	48,300
1924	27,498,000	75,200	11,000	.....	6,420,000	282,000	800	9,103,000	24,900	18,124,000	49,500
1925	31,055,000	85,100	37,000	100	7,253,000	833,000	2,300	9,678,000	26,500	20,581,000	56,400
1926	32,293,000	88,500	33,000	100	7,576,000	323,000	900	9,348,000	25,600	22,655,000	62,100
1927	31,721,000	86,900	8,000	.....	7,860,000	284,000	800	9,732,000	26,600	21,713,000	59,500
1928	34,658,000	94,700	13,000	.....	.....	480,000	1,300	10,908,000	29,800	23,283,000	63,600
1929	34,359,000	93,900	39,000	100	.....	*71,000*	*200*	10,840,000	29,700	23,629,000	64,700

Note.—The 42-gallon barrel unit is used uniformly in the Institute's statistical tables. (a) Output of U. S. refineries. (b) Includes exports to foreign countries and U. S. insular possessions. (c) Imports prior to October 1922 not available. (d) Due to revised method of reporting stocks in California, total stocks in U. S. on December 31, 1923, comparable with subsequent months, amounted to 6,138,000 bbl.

Authorities: Figures for "production" and "stocks" are taken from Bureau of Mines reports, and those for "imports" and "exports" from the Bureau of Foreign and Domestic Commerce reports.

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